# FIBER OPTIC SENSORS




## Fiber Sensor Overview page 220

- Fiber Systems Explained
- When to Use Fiber Systems
- Selection information for sensors and fibers
- Choosing Plastic or Glass Fibers

## D10 page 222

- Advanced amplifier for use with plastic fibers
- High-performance, low-contrast sensor with numeric or bargraph display
- Models with push-button programming or manual gain adjustment
- Bussable power models for simplified wiring

## D12 page 231

- Glass and plastic fiber optic models
- Models for standard applications, high-speed response and increased power
- AC-coupled for high-sensitivity applications

## R55F page 236

- Green, blue, white, red or infrared LED colors
- For mounting flat or to a 35 mm DIN rail
- Models for glass and plastic fiber optics

## Plastic Fibers page 239

- Inexpensive and easily cut to length during installation
- Very bendable, for a precise fit
- Available coiled, for applications requiring articulated or reciprocating motion
- Diameters of 0.25, 0.5, 1.0 or 1.5 mm

## Glass Fibers page 256

- For hostile environments: high temperatures, corrosive materials, extreme moisture and high levels of shock and vibration
- Inherent immunity to extreme electrical noise
- Quickly custom designed and built for your unique applications

# The broadest selection of fiber sensors in the world.

## Fiber Systems

Two-part fiber systems include the sensor and the separately purchased application-specific fiber.

**1. Sensors**

The sensor contains all the electronics, the amplifier and the mechanical interface to the fiber. Some models are sealed and rated IP67 to mount directly on a machine; others are designed to be DIN-rail mounted in a centralized control enclosure.

**2. Fibers**

Sensing fibers are non-electronic, light-transmitting, optical-quality glass or plastic strands encased in cladding that reflects light to the core. Fibers transmit and/or receive light from the LED of a sensor. Glass fibers are arranged in bundles, and plastic fibers are typically packaged as monofilaments with a protective jacket of polyethylene, PVC, stainless-steel braid or other material. Fiber sensing tips have a wide variety of shapes and configurations.

## When to Use Fiber Systems

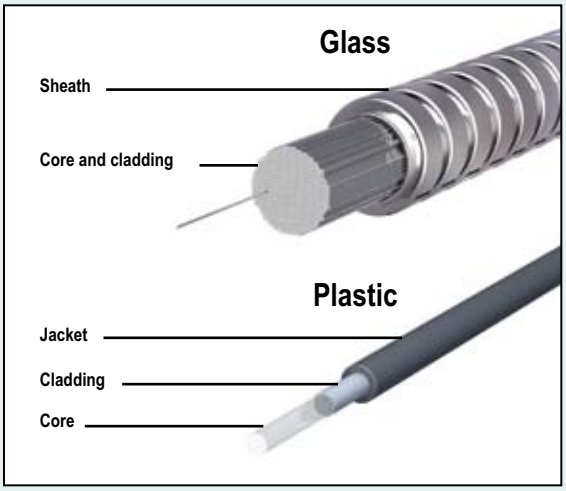
- **Confined areas.** The small size and flexibility of fibers allows precise positioning where space is limited.
- **High temperatures.** Fiber optic assemblies can tolerate elevated temperatures—in some cases as high as 480° C.
- **High vibration and shock.** The low mass of fibers enables them to withstand extreme vibration and mechanical shock.
- **Corrosive and wet environments.** Special purpose fibers withstand corrosive materials, moisture and even repeated washdown.
- **Explosive environments.** Fibers are passive and can safely pipe light to and from hazardous areas.
- **Noisy environments.** Fibers are non-electronic mechanical components and are completely immune to electrical noise.
- **Unique target shapes and requirements.** Fiber optic sensing heads can be custom designed and optimally shaped to the physical and optical requirements of a specific application.

## Typical Applications

- Punch presses
- Vibratory feeders
- Conveyors
- Web control
- Tablet counting
- Ovens
- Semiconductor processing equipment
- Liquid level

| Sensor Model | Models for Plastic Fibers | Page Number | Models for Glass Fibers | Page Number |
|---|---|---|---|---|
| WORLD-BEAM® QS18 |  | page 88 |  | page 88 |
| MINI-BEAM® |  | page 107 |  | page 107 |
| QM42 |  | page 179 | | |
| Q45 |  | page 186 |  | page 186 |
| OMNI-BEAM™ |  | page 203 |  | page 203 |
| D10 |  | page 222 | | |
| D12 |  | page 231 |  | page 231 |
| R55F |  | page 236 |  | page 236 |
| FI22 |  | page 42 | | |
| D11 |  | page 42 | | |
| ECONO-BEAM® |  | page 42 |  | page 42 |
| MAXI-BEAM® |  | page 43 |  | page 43 |
| MULTI-BEAM® | | |  | page 43 |
| PC44 |  | See data sheet | | |
| VALU-BEAM® |  | page 43 |  | page 43 |

## Fiber Construction




**Core** Thin glass or plastic center of the fiber through which light travels.

**Cladding** Outer optical material surrounding the core that reflects light back into the core.

**Jacket/ Sheath** Protective layer to protect fiber from damage and moisture.

# Choosing Plastic or Glass

Plastic fibers are for general purpose use. They tolerate severe flexing, can be cut to length in the field and cost less than glass fibers. Glass fibers are the best choice for challenging environments such as high temperatures, corrosive materials and moisture.

**Plastic fibers** **page 239**

- Inexpensive and easily cut to length during installation
- Bend for a precise fit
- Available in high-flex models to withstand flexing
- Offered with special jackets that withstand corrosion, impact and abrasion
- Available in coiled versions for applications requiring articulated or reciprocating motion
- Available in diameters of 0.25, 0.5, 1.0 or 1.5 mm
- Can be quickly custom designed and built for your unique applications

**Glass fibers** **page 256**

- Solve numerous challenging sensing requirements
- Ideal for hostile environments such as high temperatures to 480° C, corrosive materials and extreme moisture
- Withstand high levels of shock and vibration
- Inherently immune to extreme electrical noise
- Available with choice of sheathings: standard stainless-steel flexible conduit, PVC or other flexible tubing
- Can be quickly custom designed



# Specialty fibers for specific sensing applications.

DURA-BEND™ for extremely tight radius bends

Fluoropolymer encapsulated fibers

Focused beam fibers

Convergent beam fibers

Linear array fibers

Liquid level detection fibers

High temperature fibers

SteelSkin™ for impact and abrasion

SENSORS

# D10 Series

## Redefining High-Performance Fiber Optic Sensing

- Features advanced fiber optic amplifier for use with plastic fibers
- Available in bipolar, discrete and analog/discrete output models
- Available with a numeric or bargraph display on *Expert*™ models
- Delivers high-performance, low-contrast sensing with automatic TEACH options or manual adjustment
- Available with visible red or green beam
- Provides light-operate or dark-operate operation
- Includes specially designed models for reliable detection of objects as small as 1.5 mm
- Features bussable models for side-by-side mounting and simplified wiring of up to 16 sensors
- Features thin 10 mm housing for standard 35 mm DIN-rail mounting

ACCESSORIES page 229

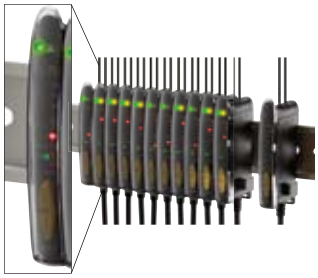
PLASTIC FIBERS PAGE 239

PLASTIC FIBER

### D10 *Expert*™ with Numeric Display

page 223

- Numeric display of signal strength and operating status
- Two output options: two discrete outputs in the same sensor; or discrete output and either a 4-20 mA current or a 0-10V dc voltage analog output in the same sensor
- Push buttons for easy-to-set static, dynamic light set, dark set and window set programming
- Manual fine tuning and remote configuration using TEACH wire
- Four mode power and speed selection with automatic crosstalk avoidance circuitry
- Response times as fast as 50 microseconds



### D10 *Expert*™ with Bargraph Display

page 224

- Easy-to-read 8-segment light bar display indicator for TEACH and signal strength
- Bipolar discrete outputs: one current sourcing (PNP) and one current sinking (NPN)
- Push buttons for easy-to-set static, dynamic light set, dark set and window SET programming
- Manual fine tuning
- Bussable power models with improved temperature compensation for side-by-side mounting and simplified wiring of up to 16 sensors
- Selectable high-speed mode option for 200 microsecond response

### D10—Discrete Output

page 224

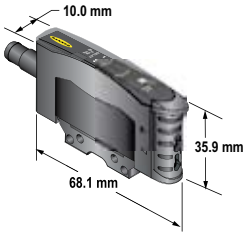
- 12-turn manual sensitivity adjustment
- Pulse rate LED indicator for signal strength
- Bipolar discrete outputs: one current sourcing (PNP) and one current sinking (NPN)
- Response time as fast as 200 microseconds

### D10 *Expert*™ Small Object Counter

page 225

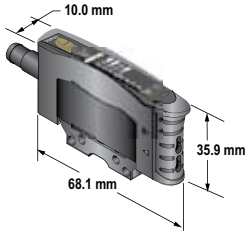
- Reliable low-contrast sensing for small object counting
- Easy-to-set selectable threshold with automatic compensation algorithm to compensate for dust or contamination on the fiber optic array and for ambient temperature changes
- Single discrete output plus Health mode output to indicate preventative maintenance is required
- A choice of three standard size fiber optic assemblies
- Custom size fibers for your application
- User-configurable Dynamic Event Stretcher (DES) to prevent double counting of objects
- Push buttons or remote wire for easy sensor configuration

ACCESSORIES page 229




D10—Discrete Models

ONLINE
AUTOCAD, STEP, IGES & PDF

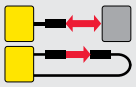
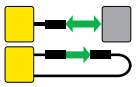



D10 *Expert*™ Models with Bargraph Display


D10 *Expert*™ Models with Numeric Display

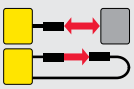
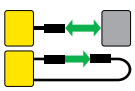
## D10 *Expert*™ with Numeric Display—Dual Discrete, 12-24V dc

Visible Red LED  Visible Green LED

| Sensing Mode/LED | Range | Connection | Models Dual NPN | Models Dual PNP |
|---|---|---|---|---|
|  PLASTIC FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See data sheet for range information. | 2 m | D10DNFP | D10DPFP |
| | | 6-pin Snap-on Pico QD | D10DNFPQ | D10DPFPQ |
|  PLASTIC FIBER | | 2 m | D10DNFPG | D10DPFPG |
| | | 6-pin Snap-on Pico QD | D10DNFPGQ | D10DPFPGQ |

## D10 *Expert*™ with Numeric Display—Analog/Discrete, 12-24V dc

Visible Red LED  Visible Green LED

| Sensing Mode/LED | Range | Connection | Analog Output | Models NPN | Models PNP |
|---|---|---|---|---|---|
|  PLASTIC FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See data sheet for range information. | 2 m | 4-20 mA | D10INFP | D10IPFP |
| | | 6-pin Snap-on Pico QD | | D10INFPQ | D10IPFPQ |
|  PLASTIC FIBER | | 2 m | 4-20 mA | D10INFPG | D10IPFPG |
| | | 6-pin Snap-on Pico QD | | D10INFPGQ | D10IPFPGQ |

**Connection options:** A model with a QD requires a mating cordset (see page 229).

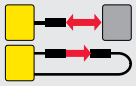
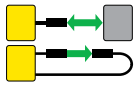
For 9 m cable, add suffix **W/30** to the 2 m model number (example, **D10DNFP W/30**).

SENSORS

ACCESSORIES page 229

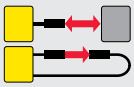
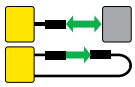
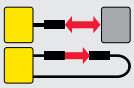
## D10 *Expert*™ with Numeric Display—Analog/Discrete, 15-24V dc

Visible Red LED  Visible Green LED

| Sensing Mode/LED | Range | Connection | Analog Output | Models NPN | Models PNP |
|---|---|---|---|---|---|
|  PLASTIC FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 239 or reference data sheet for range information. | 2 m | 0-10V | D10UNFP | D10UPFP |
| | | 6-pin Snap-on Pico QD | | D10UNFPQ | D10UPFPQ |
|  PLASTIC FIBER | | 2 m | 0-10V | D10UNFPG | D10UPFPG |
| | | 6-pin Snap-on Pico QD | | D10UNFPGQ | D10UPFPGQ |

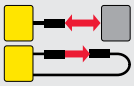
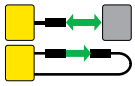
## D10 *Expert*™ with Bargraph Display—Discrete

Visible Red LED  Visible Green LED

| Sensing Mode/LED | Range | Connection | Output Type | Supply Voltage | Description | Models | Excess Gain | Beam Pattern |
|---|---|---|---|---|---|---|---|---|
|  PLASTIC FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 239 or reference data sheet for range information. | 2 m | Bipolar NPN/PNP | 10 to 30V dc | Standard models | D10BFP | EGC-1 to EGC-4 (p. 229) | BP-1 to BP-4 (p. 230) |
| | | 6-pin Snap-on Pico QD | | | | D10BFPQ | | |
|  PLASTIC FIBER | | 2 m | | | | D10BFPG | EGC-5 to EGC-8 (p. 229) | BP-5 to BP-8 (p. 230) |
| | | 6-pin Snap-on Pico QD | | | | D10BFPGQ | | |
| **Bussable Power Models** | | | | | | | | |
|  PLASTIC FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 239 or reference data sheet for range information. | 2 m | Bipolar NPN/PNP | 12 to 30V dc | Main unit | D10B5FP | EGC-1 to EGC-4 (p. 229) | BP-1 to BP-4 (p. 230) |
| | | | PNP | | Sub unit | D10B2PFP | | |
| | | | NPN | | Sub unit | D10B2NFP | | |

## D10—Discrete, 10-30V dc

Visible Red LED  Visible Green LED

| Sensing Mode/LED | Range | Connection | Output Type | Response Time | Models |
|---|---|---|---|---|---|
|  PLASTIC FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 239 or reference data sheet for range information. | 2 m | Bipolar NPN/PNP | 500 microseconds | D10AFP |
| | | 4-pin Snap-on Pico QD | | | D10AFPQ |
|  PLASTIC FIBER | | 2 m | Bipolar NPN/PNP | 500 microseconds | D10AFPG |
| | | 4-pin Snap-on Pico QD | | | D10AFPGQ |

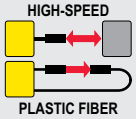
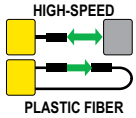
More on next page

**Connection options:** A model with a QD requires a mating cordset (see page 229).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **D10UNFP W/30**).

## D10—Discrete, 10-30V dc (cont'd)

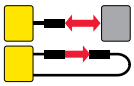
Visible Red LED  Visible Green LED

| Sensing Mode/LED | Range | Connection | Output Type | Response Time | Models |
|---|---|---|---|---|---|
|  HIGH-SPEED PLASTIC FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 239 or reference data sheet range information. | 2 m | Bipolar NPN/PNP | 200 microseconds | D10AFPY |
| | | 4-pin Snap-on Pico QD | | | D10AFPYQ |
|  HIGH-SPEED PLASTIC FIBER | | 2 m | Bipolar NPN/PNP | 200 microseconds | D10AFPGY |
| | | 4-pin Snap-on Pico QD | | | D10AFPGYQ |

## D10 *Expert*™ Small Object Counter with Numeric Display—Discrete, 12-24V dc

Visible Red LED

ACCESSORIES page 229

| Sensing Mode/LED | Connection | Output | Sensor Models |
|---|---|---|---|
|  PLASTIC FIBER | 2 m | NPN | D10DNCFP |
| | 6-pin Snap-on Pico QD | | D10DNCFPQ |
| | 2 m | PNP | D10DPCFP |
| | 6-pin Snap-on Pico QD | | D10DPCFPQ |

### Fiber Optic Arrays

| Detection Window Dimensions** | Fiber Exit | Minimum Object Detection† | Array Models* |
|---|---|---|---|
| 10 x 25 mm | Side Exit | 1.5 mm | PFCVA-10X25-S |
| | End Exit | | PFCVA-10X25-E |
| 25 x 25 mm | Side Exit | 3 mm | PFCVA-25X25-S |
| | End Exit | | PFCVA-25X25-E |
| 34 x 25 mm | Side Exit | 4 mm | PFCVA-34X25-S |
| | End Exit | | PFCVA-34X25-E |

**Connection options:** A model with a QD requires a mating cordset (see page 229).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **D10DNDFP W/30**).

* Custom fiber arrays and mounting configurations are possible. Consult factory for assistance with your small object counting application.
** Detailed dimension drawings for fibers are on page 254.
† With 2% Threshold Offset Percentage



## D10 *Expert*™ with Numeric Display—Dual-Discrete Specifications

| | |
|---|---|
| **Required Fiber Optic Cable** | Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 239) |
| **Supply Voltage and Current** | 12 to 24V dc (10% max. ripple) at less than 65 mA, exclusive of load |
| **Supply Protection Circuitry** | Protected against reverse polarity and transient voltage. |
| **Output Configuration** | Two independently configured current sourcing (PNP) or current sinking (NPN) solid-state transistors, depending on model. |
| **Output Rating** | 150 mA max. load<br>**OFF-state leakage current:** less than 10 µA at 24V dc<br>**ON-state saturation voltage: NPN:** less than 1.5V at 150 mA load **PNP:** less than 2.5V at 150 mA load |
| **Output Protection Circuitry** | Protected against false pulse on power-up and continuous short-circuit |

More on next page

## D10 *Expert*™ with Numeric Display—Dual-Discrete Specifications (cont'd)

| | |
|---|---|
| **Output Response Time** | Programmable, 50 microseconds, 200 microseconds, 1 millisecond, 2.5 milliseconds |
| **Delay at Power-up** | Less than 1 second; outputs do not conduct during this time. |
| **Adjustments** | Two push buttons or remote programming of (TEACH) switching threshold response time, OFF-delay, light/dark operate, and display |
| **Indicators** | Four-digit digital display plus LED indicators for active channel, push-button lockout, OFF-delay and light/dark operate selection; two yellow LED output indicators. |
| **Construction** | Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover. |
| **Environmental Rating** | IEC IP50; NEMA 1 |
| **Connections** | PVC-jacketed 2 m or 9 m 6-wire integral cable, or integral 6-pin Pico-style quick-disconnect fitting. QD cordsets are ordered separately. See page 229. |
| **Operating Conditions** | **Temperature:** -20° to +55° C **Storage Temperature:** -20° to +80° C **Relative humidity:** 90% @ 50° C |

| Number of Devices Stacked | Ambient Temperature Rating | Load Specification |
|---|---|---|
| 3 | 55° C | 150 mA |
| 7 | 50° C | 50 mA |
| 10 | 45° C | 50 mA |

| | |
|---|---|
| **Installation** | 35 mm DIN rail or included mounting bracket |
| **Certifications** | CE cULus |
| **Hookup Diagrams** | DC15 (p. 719) |

## D10 *Expert*™ with Numeric Display—Analog/Discrete Specifications

| | |
|---|---|
| **Required Fiber Optic Cable** | Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 239) |
| **Supply Voltage and Current** | **4-20 mA Analog Models:** 12-24V dc (10% max. ripple) at less than 65 mA exclusive of load<br>**0-10V dc Analog Models:** 15-24V dc (10% max. ripple) at less than 70 mA exclusive of load |
| **Supply Protection Circuitry** | Protected against reverse polarity and transient voltage. |
| **Output Configuration** | Two independently configurable outputs, depending on model: NPN w/analog (4-20 mA or 0-10V) or PNP w/analog (4-20 mA or 0-10V) |
| **Output Rating** | **Discrete Output:** 150 mA, max. load<br>**OFF-state leakage current:** less than 10 µA at 24V dc<br>**ON-state saturation voltage:** **NPN:** < 1.5V @ 150 mA<br>**PNP:** < 2.5V @ 150 mA<br>**Analog Output:** 4-20 mA or 0-10V dc<br>**Load:** **4-20 mA Models:** 100Ω max. impedance<br>**0-10V dc Models:** 1 MΩ min. impedance |
| **Output Protection Circuitry** | Protected against false pulse on power-up and continuous short-circuit |
| **Output Response Time** | **Discrete Output:** Programmable, 50 microseconds, 200 microseconds, 1 millisecond, 2.5 milliseconds<br>**Analog Output:** 1 millisecond |
| **Delay at Power-up** | Less than 1 second; outputs do not conduct during this time. |
| **Adjustments** | Push-button or remote programming of (TEACH) switching threshold response time, OFF-delay, light/dark operate, and display |
| **Indicators** | Four-digit digital display plus LED indicators for active channel, push-button lockout, OFF-delay and light/dark operate selection; two yellow output indicators. |
| **Construction** | Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover. |
| **Environmental Rating** | IEC IP50; NEMA 1 |
| **Connections** | PVC-jacketed 2 m or 9 m 6-wire integral cable, or integral 6-pin Pico-style quick-disconnect. QD cordsets are ordered separately. See page 229. |
| **Operating Conditions** | **Temperature:** -20° to +55° C **Storage Temperature:** -20° to +80° C **Relative humidity:** 90% @ 50° C |

| Number of Devices Stacked | Ambient Temperature Rating | Load Specification |
|---|---|---|
| 3 | 55° C | 150 mA |
| 7 | 50° C | 50 mA |
| 10 | 45° C | 50 mA |

| | |
|---|---|
| **Installation** | 35 mm DIN rail or included mounting bracket |
| **Certifications** | CE cULus |
| **Hookup Diagrams** | **NPN Models:** DC16 (p. 719) **PNP Models:** DC17 (p. 720) |

## D10 *Expert*™ with Bargraph Display—Discrete Specifications

| | Standard Sensors | Models with Bussable Power |
|---|---|---|
| **Required Fiber Optic Cable** | Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 239) | |
| **Supply Voltage and Current** | 10 to 30V dc (10% max. ripple) at less than 45 mA, exclusive of load | 12 to 30V dc (10% max. ripple) at less than 45 mA, exclusive of load |
| **Supply Protection Circuitry** | Protected against reverse polarity, over voltage and transient voltage. | |
| **Delay at Power Up** | 200 milliseconds max.; outputs do not conduct during this time | 850 milliseconds max.; outputs do not conduct during this time |
| **Output Configuration** | **Bipolar:** 1 current sourcing (PNP) and 1 current sinking (NPN) | **Main units:** Bipolar; 1 current sourcing (PNP) and 1 current sinking (NPN)<br>**Sub-units:** 1 current sourcing (PNP) or 1 current sinking (NPN) output, depending on model |
| **Output Rating** | 150 mA max. load @ 25° C (derate 1 mA per ° C increase)<br>**OFF-state leakage current:** less than 5 µA at 30V dc<br>**ON-state saturation voltage:**<br>**NPN:** less than 200 mV at 10 mA and 1V at 150 mA load<br>**PNP:** less than 1V at 10 mA and 1.5V at 150 mA load | 100 mA max. load (derate 1 mA per ° C)<br>**OFF-state leakage current:** less than 5 µA at 30V dc<br>**ON-state saturation voltage: NPN:** less than 1.5V **PNP:** less than 2V<br>**Less than 15V supply (9 m cable):**<br>up to 4 units with 100 mA outputs<br>up to 8 units with 50 mA outputs |
| **Output Protection Circuitry** | Protected against output short-circuit, continuous overload, transient over-voltages, and false pulse on power-up | |
| **Output Response Time** | 500 microseconds (normal mode) or 200 microseconds (high-speed mode) | |
| **Repeatability** | 100 microseconds (normal mode) or 66 microseconds (high-speed mode) | |
| **Adjustments** | Two push buttons and remote wire<br>• *Expert* -style configuration (Static and Dynamic TEACH, light SET, dark SET and Windows SET)<br>• Manually Adjust (+/–) sensitivity (from buttons only)<br>• LO/DO, OFF-Delay, and response speed configurable (from buttons or remote wire)<br>• Push-button lockout (from remote wire only)<br>**Factory Default Settings:** Light Operate, Normal Speed, No Delay | |
| **Indicators** | **8-segment red bargraph***<br>**Green Status Indicators:** LO, DO, High Speed (HS) and OFF-Delay<br>**Green LED:** Power ON<br>**Yellow LED:** Output conducting<br>*See data sheet for detailed information | |
| **Construction** | Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover. | |
| **Environmental Rating** | IEC IP50, NEMA 1 | |
| **Connections** | PVC-jacketed 2 m or 9 m 6-wire integral cable, or integral 6-pin Pico-style quick-disconnect. QD cordsets are ordered separately. See page 229. | **Main units:** PVC-jacketed 2 m or 9 m 5-wire integral cable<br>**Sub-units:** PVC-jacketed 2 m or 9 m 2-wire integral cable |
| **Operating Conditions** | **Temperature:** -10° to +55° C **Storage Temperature:** -20° to +85° C **Relative humidity:** 90% @ 55° C | |
| **Installation** | 35 mm DIN rail or included mounting bracket | |
| **Certifications** | CE c UL us | |
| **Hookup Diagrams** | **Standard Models and Main Unit:** DC08 (p. 717) **Sub-Units:** DC09 (p. 718) | |

## D10—Discrete Specifications

| | |
|---|---|
| **Required Fiber Optic Cable** | Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 239) |
| **Supply Voltage & Current** | 10 to 30V dc (10% max. ripple) @ less than 25 mA, exclusive of load |
| **Supply Protection Circuitry** | Protected against reverse polarity and transient voltage |
| **Output Configuration** | **Bipolar:** 1 current sourcing (PNP) and 1 current sinking (NPN) |
| **Output Rating** | 100 mA per output with short circuit protection<br>**OFF-state leakage current:** less than 10 µA sourcing; 200 µA sinking<br>**ON-state saturation voltage:**<br>**NPN:** 1.6V @ 100 mA<br>**PNP:** 2.0V @ 100 mA |
| **Output Protection Circuitry** | Protected against output short-circuit and false pulse on power up |
| **Delay at Power-up** | Max. 100 milliseconds; outputs do not conduct during this time |

More on next page

## D10—Discrete Specifications (cont'd)

| | |
|---|---|
| **Output Response Time** | **Standard models (with crosstalk avoidance circuitry):** 500 microseconds<br>**High-speed models:** 200 microseconds |
| **Repeatability** | **Standard models:** 95 microseconds<br>**High-speed models:** 50 microseconds |
| **Adjustments** | 12-turn Sensitivity potentiometer with relative position indicator; LO/DO Selection switch;<br>0 or 40 milliseconds OFF-delay switch<br>NOTE: Use proper ESD techniques while making adjustments under cover. |
| **Indicators** | **Two LEDs:** Green and Yellow<br>**Green:** Power ON<br>**Yellow:** Light Sensed Signal strength indicator<br>See data sheet for detailed information |
| **Construction** | Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover. |
| **Environmental Rating** | IEC IP50; NEMA 1 |
| **Connections** | PVC-jacketed 2 m or 9 m attached cable, or 4-pin Pico-style quick-disconnect fitting. QD cordsets are ordered separately. See page 229. |
| **Operating Conditions** | **Temperature:** -10° to +55° C **Storage:** -20° to +85° C **Relative humidity:** 90% @ 55° C (non-condensing) |
| **Certifications** | CE c UL us |
| **Hookup Diagrams** | DC04 (p. 716) |

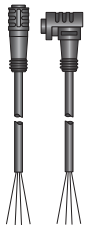
## D10 *Expert*™ Small Object Counter—Numeric Display Specifications

| | |
|---|---|
| **Required Fiber Optics** | PFCVA models (Custom fiber arrays and mounting configurations are possible. Consult factory for assistance with your small object counting application.) |
| **Sensing Beam** | Visible red, 680 nm |
| **Supply Voltage and Current** | 12 to 24V dc (10% maximum ripple) at less than 65 mA, exclusive of load |
| **Supply Protection Circuitry** | Protected against reverse polarity and transient voltage |
| **Output Configuration** | 2 NPN or 2 PNP, depending on model |
| **Output Rating** | 150 mA maximum load<br>**OFF-state leakage current:** < 10 µA at 24V dc<br>**ON-state saturation voltage: NPN** < 1.5V at 150 mA load<br>**PNP** < 2.5V at 150 mA load |
| **Output Protection Circuitry** | Protected against false pulse on power-up and continuous short-circuit |
| **Output Response Time** | Programmable, 150 µs, 225 µs, 300 µs |
| **Delay at Power-up** | Less than 1 second; outputs do not conduct during this time. |
| **Adjustments** | Push-button or remote programming of threshold offset percentage, light/dark operate, Dynamic Event Stretcher (DES), display, and power/speed |
| **Indicators** | Four-digit digital display, 2 arrow icons, push-button lockout, Dynamic Event Stretcher, light/dark operate selection and 2 amber output LEDs |
| **Construction** | Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover |
| **Environmental Rating** | NEMA 1; IEC IP50 |
| **Connections** | PVC-jacketed 2 m or 9 m 6-wire integral cable or integral 6-pin Pico-style quick-disconnect. QD cordsets are ordered separately. See page 229. |
| **Operating Conditions** | **Temperature:** -20° to +55° C<br>**Storage Temperature:** -20° to +80° C<br>**Relative Humidity:** 90% @ 50° C (non-condensing) |
| **Installation** | 35 mm DIN rail or included mounting bracket |
| **Certifications** | CE |
| **Hookup Diagrams** | DC18 (p. 720) |

| Number of Devices, Stacked | Ambient Temperature Rating | Load Specification |
|---|---|---|
| 3 | 55° C | 150 mA |
| 7 | 50° C | 50 mA |
| 10 | 45° C | 50 mA |

## Cordsets

| Pico QD | | | | |
|---|---|---|---|---|
| See page 656 | | | | |
| Length | Snap-on 4-Pin | | Snap-on 6-Pin | |
| | Straight | Right-Angle | Straight | Right-Angle |
| 2 m | PKG4-2 | PKW4Z-2 | PKG6Z-2 | PKW6Z-2 |
| 9 m | — | — | PKG6Z-9 | PKW6Z-9 |



Additional cordset information available. See page 655.

## Brackets

| D10 | | |
|---|---|---|
|  |  |  |
| pg. 608 | pg. 650 | pg. 650 |
| DIN-35... | SMBR55F01 | SMBR55FRA |

Additional bracket information available. See page 601.

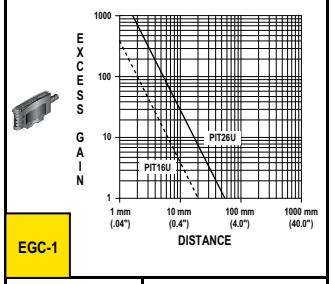


## Excess Gain Curves

(Diffuse-mode performance based on 90% reflectance white test card)

● = Visible Red LED ● = Visible Green LED

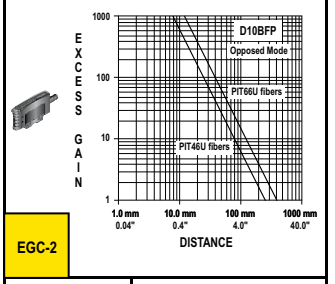
### Opposed Mode D10 *Expert*™ with Bargraph




EGC-1

**Range:** Varies **LED:** ●

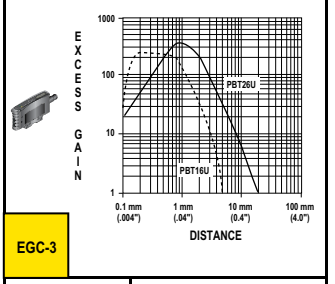
### Opposed Mode D10 *Expert*™ with Bargraph




EGC-2

**Range:** Varies **LED:** ●

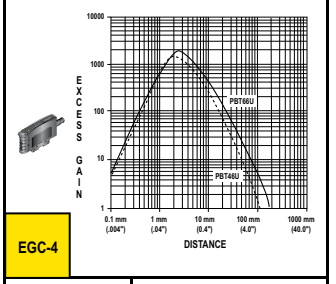
### Diffuse Mode D10 *Expert*™ with Bargraph




EGC-3

**Range:** Varies **LED:** ●

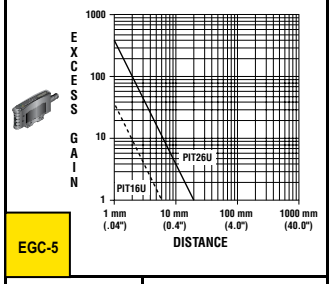
### Diffuse Mode D10 *Expert*™ with Bargraph




EGC-4

**Range:** Varies **LED:** ●

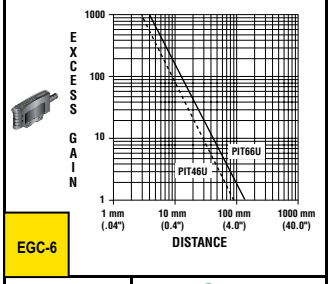
### Opposed Mode D10 *Expert*™ with Bargraph




EGC-5

**Range:** Varies **LED:** ●

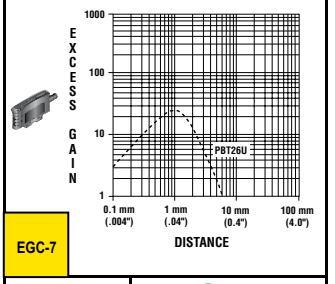
### Opposed Mode D10 *Expert*™ with Bargraph




EGC-6

**Range:** Varies **LED:** ●

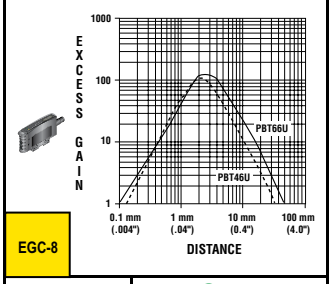
### Diffuse Mode D10 *Expert*™ with Bargraph




EGC-7

**Range:** Varies **LED:** ●

### Diffuse Mode D10 *Expert*™ with Bargraph




EGC-8

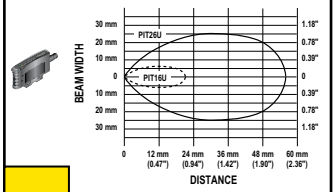
**Range:** Varies **LED:** ●

## Beam Patterns

(Diffuse-mode performance based on 90% reflectance white test card)

● = Visible Red LED ● = Visible Green LED

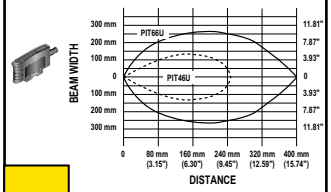
### Opposed Mode D10 *Expert*™ with Bargraph




BP-1

**Range:** Varies **LED:** ●

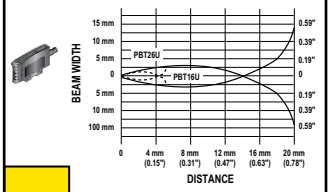
### Opposed Mode D10 *Expert*™ with Bargraph




BP-2

**Range:** Varies **LED:** ●

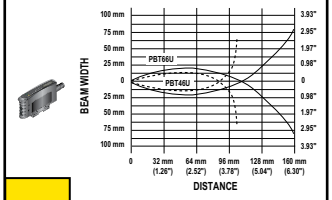
### Diffuse Mode D10 *Expert*™ with Bargraph




BP-3

**Range:** Varies **LED:** ●

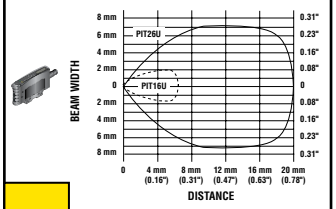
### Diffuse Mode D10 *Expert*™ with Bargraph




BP-4

**Range:** Varies **LED:** ●

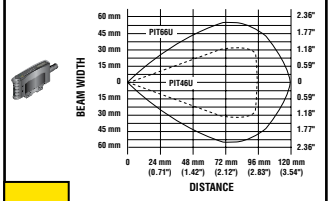
### Opposed Mode D10 *Expert*™ with Bargraph




BP-5

**Range:** Varies **LED:** ●

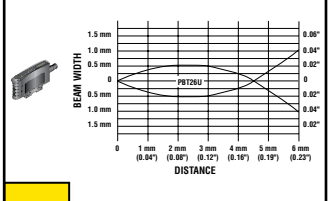
### Opposed Mode D10 *Expert*™ with Bargraph




BP-6

**Range:** Varies **LED:** ●

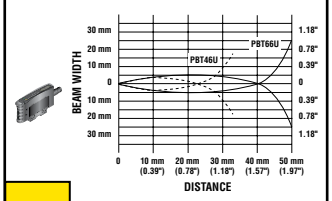
### Diffuse Mode D10 *Expert*™ with Bargraph




BP-7

**Range:** Varies **LED:** ●

### Diffuse Mode D10 *Expert*™ with Bargraph




BP-8

**Range:** Varies **LED:** ●

# D12
## Complete Family of Plastic and Glass Fiber Optic Sensors

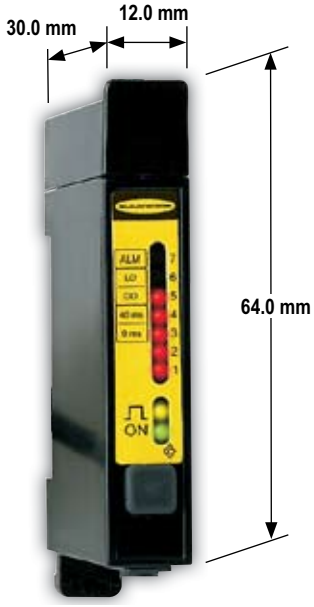
- Features LED bargraph that indicates signal strength, sensing contrast, programming status and diagnostic warnings, when not in high-speed mode
- Available in glass and plastic fiber optic models
- Includes marginal gain indicator with alarm output
- Solves routine applications with economical standard models
- Features high-speed sensing response and higher sensing power in some models
- Excels in low-contrast applications with ac-coupled models
- Features easy push-button TEACH-mode setup on D12E *Expert*™ models
- Easily mounts to standard 35 mm DIN-rail mounting



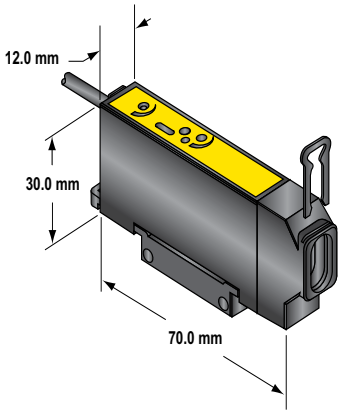
ACCESSORIES page 235



PLASTIC FIBERS PAGE 239
GLASS FIBERS PAGE 256
PLASTIC FIBER
GLASS FIBER

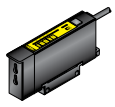



Plastic Fiber Models
Suffix FP and FPY




Glass Fiber Models
Suffix FV and FVY

ONLINE
AUTOCAD, STEP, IGES & PDF



Visible Red LED

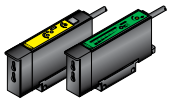
## D12 *Expert*™, 10-30V dc

| Sensing Mode/LED | Maximum Range | Switching Threshold Setting | Connection | Models NPN | Models PNP |
|---|---|---|---|---|---|
| GLASS FIBER | Range varies by sensing mode and fiber optics used. See data sheet for maximum range specifications. | Just above the "dark" condition | 2 m | D12EN6FV | D12EP6FV |
| | | Midway between "dark" and "light" conditions | | D12E2N6FV | D12E2P6FV |
| PLASTIC FIBER | | Just above the "dark" condition | | D12EN6FP | D12EP6FP |
| | | Midway between "dark" and "light" conditions | | D12E2N6FP | D12E2P6FP |

**Connection options:** A model with a QD requires a mating cordset (see page 235).

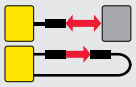
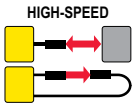
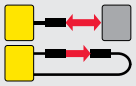
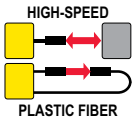
For 9 m cable, add suffix **W/30** to the 2 m model number (example, **D12EN6FV W/30**).

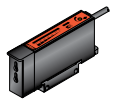
ACCESSORIES page 235



## D12 and D12 High-Speed, 10-30V dc

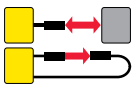
Visible Red LED

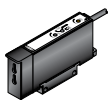
| Sensing Mode/LED | Range | Connection | Output Response | Models NPN | Models PNP | Excess Gain |
|---|---|---|---|---|---|---|
|  GLASS FIBER | Range varies by sensing mode and fiber optics used | 2 m | 500 µs | **D12SN6FV** | **D12SP6FV** | EGC-1 & EGC-2 (p. 235) |
| | | 4-Pin Pico Pigtail QD | | **D12SN6FVQ** | **D12SP6FVQ** | |
|  HIGH-SPEED GLASS FIBER | | 2 m | Selectable 50 µs or 500 µs*** | **D12SN6FVY** | **D12SP6FVY** | EGC-3 & EGC-4 (p. 235) |
| | | 4-Pin Pico Pigtail QD | | **D12SN6FVYQ** | **D12SP6FVYQ** | |
| | | 2 m | | **D12SN6FVY1**† | **D12SP6FVY1**† | |
| | | 4-Pin Pico Pigtail QD | | **D12SN6FVY1Q**† | **D12SP6FVY1Q**† | |
|  PLASTIC FIBER | Range varies by sensing mode and fiber optics used | 2 m | 500 µs | **D12SN6FP** | **D12SP6FP** | EGC- 5 & EGC-6 (p. 235) |
| | | 4-Pin Pico Pigtail QD | | **D12SN6FPQ** | **D12SP6FPQ** | |
|  HIGH-SPEED PLASTIC FIBER | | 2 m | Selectable 50 µs or 500 µs*** | **D12SN6FPY** | **D12SP6FPY** | EGC-7 & EGC-8 (p. 235) |
| | | 4-Pin Pico Pigtail QD | | **D12SN6FPYQ** | **D12SP6FPYQ** | |
| | | 2 m | | **D12SN6FPY1**† | **D12SP6FPY1**† | |
| | | 4-Pin Pico Pigtail QD | | **D12SN6FPY1Q**† | **D12SP6FPY1Q**† | |



## D12 High-Power, 10-30V dc

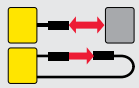
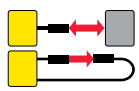
Visible Red LED

| Sensing Mode/LED | Range | Connection | Output Response | Models NPN | Models PNP | Excess Gain |
|---|---|---|---|---|---|---|
|  PLASTIC FIBER | Range varies by sensing mode and fiber optics used | 2 m | 500 µs | **D12SN6FPH** | **D12SP6FPH** | EGC- 9 & EGC-10 (p. 235) |
| | | 4-Pin Pico Pigtail QD | | **D12SN6FPHQ** | **D12SP6FPHQ** | |



## D12 AC-Coupled, 10-30V dc

Visible Red LED

| Sensing Mode/LED | Range | Connection | Output Type | Output Response | Models |
|---|---|---|---|---|---|
|  GLASS FIBER | Range varies by Power Level/Speed Selection used and with fiber optics used. See data sheet for range information. | 2 m | Bipolar NPN/PNP | 50 µs | **D12DAB6FV** |
| | | 4-Pin Pico Pigtail QD | | | **D12DAB6FVQ** |
|  PLASTIC FIBER | | 2 m | | | **D12DAB6FP** |
| | | 4-Pin Pico Pigtail QD | | | **D12DAB6FPQ** |

**Connection options:** A model with a QD requires a mating cordset (see page 235).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **D12SN6FV W/30**).

† Y1 models have 20 milliseconds output pulse stretcher.

*** When 50 microseconds is selected, bargraph is disabled.

## D12 *Expert*™ Specifications

| | |
|---|---|
| **Supply Voltage and Current** | 10 to 30V dc at 45 mA max. (exclusive of load); 10% max. ripple |
| **Supply Protection Circuitry** | Protected against reverse polarity and transient voltages |
| **Output Configuration** | **NPN** open collector (both outputs) or **PNP** open collector (both outputs), depending on model<br>**Load output:** Normally open and programmable Light or Dark-Operate;<br>**Alarm output:** Normally open |
| **Output Rating** | 150 mA max. each output<br>**OFF-state leakage current:** less than 10 µA at 30V dc<br>**ON-state saturation voltage:** less than 1 volt at 10 mA dc; less than 1.5 volts at 150 mA dc<br>The total load may not exceed 150 mA |
| **Output Protection Circuitry** | Protected against false pulse on power-up and short circuit of outputs (trips at 175 mA) |
| **Output Response Time** | 200 microseconds ON/OFF (40 milliseconds OFF when OFF-delay selected)<br>NOTE: False pulse protection circuit causes a 0.1 second delay on power-up |
| **Output Operation Mode** | Light operate or dark operate: selected by push button |
| **Output Timing Functions** | ON/OFF (no delay) or fixed 40 millisecond OFF-delay; selected by push button |
| **Repeatability** | 66 microseconds |
| **Adjustments** | Push-button TEACH-mode sensitivity setting; Remote teaching input is provided |
| **Indicators** | **Green:** power ON and flashes when ready for TEACH mode<br>**Yellow:** output conducting<br>**7-segment moving dot red LED**<br>See data sheet for detailed information |
| **Mounting Bracket** | D12 Sensors mount directly to a standard DIN rail, or may be through-hole mounted using the supplied mounting bracket and M3 x 0.5 hardware |
| **Construction** | Black ABS housing with acrylic cover, stainless steel M3 x 0.5 hardware for use with thermoplastic polyester mounting bracket (supplied); the plastic fiber clamping element is acetal |
| **Environmental Rating** | IEC IP11; NEMA 2 |
| **Connections** | PVC-jacketed 2 m or 9 m cables, or 150 mm pigtail with 4-pin Pico-style quick-disconnect (QD) are available. QD cordsets are ordered separately. See page 235. |
| **Operating Conditions** | **Temperature:** -20° to +70° C **Relative humidity:** 90% at 50° C (non-condensing) |
| **Certifications (except D10E2)** | CE c UL us |
| **Hookup Diagrams** | DC19 (p. 720) |

## D12 Standard, High-Speed and High-Power Specifications

| | |
|---|---|
| **Supply Voltage and Current** | 10 to 30V dc at 45 mA max. (exclusive of load) |
| **Supply Protection Circuitry** | Protected against reverse polarity and transient voltages |
| **Output Configuration** | Outputs are NPN (sinking) or PNP (sourcing), depending on model<br>**Complementary:** one normally open (NO) and the other normally closed (NC); NC output may be wired as diagnostic alarm output by reversing power supply connections except high speed "Y" and "Y1" suffix models (see hookups) |
| **Output Rating** | 150 mA max. each output<br>**OFF-state leakage current:** less than 10 µA at 30V dc<br>**ON-state saturation voltage:** less than 1 volt at 10 mA dc; less than 1.5 volts at 150 mA dc<br>The total load may not exceed 150 mA |
| **Output Protection Circuitry** | Protected against false pulse on power-up and short circuit of outputs |
| **Output Response Time** | **Standard and High-Power Models:** 500 microseconds ON/OFF<br>**High-Speed Models:** selectable 50 or 500 microseconds ON/OFF<br>NOTE: False pulse protection circuit causes a 0.1 second delay on power-up |
| **Output Timing Functions** | "Y1" models have fixed 20 milliseconds pulse stretcher (OFF-delay) when 50 microseconds mode is used |
| **Repeatability** | 130 microseconds; "Y" and "Y1" models have selectable 50 microseconds/500 microseconds response; repeatability in 50 microseconds mode is 15 microseconds |
| **Adjustments** | 15-turn adjustment sensitivity; "Y" and "Y1" (high speed models) also have a response mode selector switch |

More on next page

## D12 Standard, High-Speed and High-Power Specifications (cont'd)

| | |
|---|---|
| **Indicators** | Two top-mounted LED indicators, one yellow and one green, and one 7-segment red LED moving dot bargraph; Note that the 7-segment bargraph and marginal excess gain indication (bargraph segment #7) are inoperative in the 50 µs response mode of "Y" and "Y1" models<br>**Green** LED lights for DC Power ON<br>**Yellow** LED lights for normally open output conducting<br>On all models in 500 microseconds response mode, the 7-segment moving dot red LED bargraph lights to indicate relative received light signal strength; On all models in 50 and 500 microseconds response mode, segment #1 flashes to indicate OUTPUT OVERLOAD; On all models in the 500 microseconds response mode, segment #7 flashes to indicate MARGINAL EXCESS GAIN; On standard and high power models, a flashing LED corresponds to the "ON" state of the alarm output; (Alarm output not available on Y & Y1 models) |
| **Mounting Bracket** | D12 Sensors mount directly to a standard DIN rail, or may be through-hole mounted using the supplied mounting bracket and M3 x 0.5 hardware |
| **Construction** | Black ABS housing with acrylic cover, stainless steel M3 x 0.5 hardware for use with thermoplastic polyester mounting bracket (supplied); the plastic fiber clamping element is acetal |
| **Environmental Rating** | IEC IP11; NEMA 2 |
| **Connections** | PVC-jacketed 2 m or 9 m cables, or 150 mm pigtail with 4-pin Pico-style quick-disconnect (QD) are available. QD cordsets are ordered separately. See page 235. |
| **Operating Conditions** | **Temperature:** -20° to +70° C **Relative humidity:** 90% at 50° C (non-condensing) |
| **Certifications** | |
| **Hookup Diagrams** | **NPN Models:** DC05 (p. 717) **PNP Models:** DC06 (p. 717) |

## D12 AC-Coupled Specifications

| | |
|---|---|
| **Supply Voltage and Current** | 10 to 30V dc at 60 mA max. (exclusive of load) |
| **Supply Protection Circuitry** | Protected against reverse polarity and transient voltages |
| **Output Configuration** | **Bipolar:** one NPN (current sinking) and one PNP (current sourcing) open-collector transistor |
| **Output Rating** | 150 mA max. each output<br>**OFF-state leakage current:** less than 10 µA at 30V dc<br>**ON-state saturation voltage:** less than 1 volt at 10 mA dc; less than 1.5 volts at 150 mA dc<br>The total load may not exceed 150 mA |
| **Output Protection Circuitry** | Protected against false pulse on power-up and short circuit of outputs |
| **Output Response Time** | 50 microseconds ON/OFF<br>(NOTE: False pulse protection circuit causes a 0.1 second delay on power-up) |
| **Output Operation Mode** | Light operate or dark operate: selected by switch |
| **Output Timing Functions** | Pulse output; adjustable from 1 to 70 milliseconds |
| **Repeatability** | 15 microseconds ON |
| **Adjustments** | Three top-panel controls: SENSITIVITY control (15-turn slotted brass screw, clutched at both ends of adjustment), a light- or dark-operate select switch, and an OUTPUT PULSE adjustment (3/4-turn potentiometer) |
| **Indicators** | **Three top-mounted LED indicators:**<br>**Green LED:** Lights to indicate dc Power ON<br>**Yellow LED:** Lights for Output Conducting<br>**Red LED:** Lights whenever AGC system is locked onto the signal |
| **Mounting Bracket** | D12 Sensors mount directly to a standard DIN rail, or may be through-hole mounted using the supplied mounting bracket and M3 x 0.5 hardware |
| **Construction** | Black ABS housing with acrylic cover, stainless steel M3 x 0.5 hardware for use with thermoplastic polyester mounting bracket (supplied); the plastic fiber clamping element is acetal |
| **Environmental Rating** | IEC IP11; NEMA 2 |
| **Connections** | PVC-jacketed 2 m or 9 m cables, or 150 mm pigtail with 4-pin Pico-style quick-disconnect (QD) are available. QD cordsets are ordered separately. See page 235. |
| **Operating Conditions** | **Temperature:** -40° to +70° C **Relative humidity:** 90% at 50° C (non-condensing) |
| **Application Note** | D12 AC-coupled sensors should not be used in areas of known electrical "noise" or RF fields. |
| **Certifications** | |
| **Hookup Diagrams** | DC04 (p. 716) |

## Cordsets

| Pico QD | | |
|---|---|---|
| See page 656 | | |
| Length | Snap-on 4-Pin | |
| | Straight | Right-Angle |
| 2 m | PKG4-2 | PKW4Z-2 |

Additional cordset information available. See page 655.

## Brackets

| D12 | | |
|---|---|---|
|  |  |  |
| pg. 608 | pg. 650 | pg. 650 |
| DIN-35... | SMBR55F01 | SMBR55FRA |

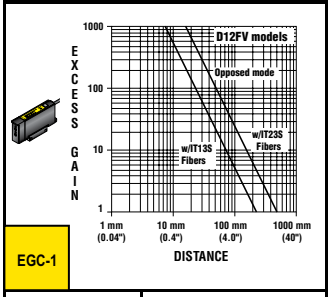
Additional bracket information available. See page 601.

## Excess Gain Curves

(Diffuse-mode performance based on 90% reflectance white test card)

● = Visible Red LED

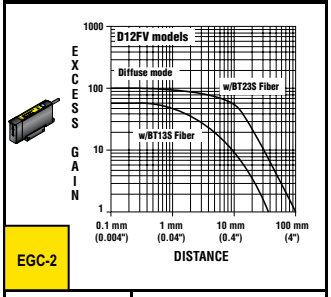
### Opposed Mode—Glass Fiber D12 Standard




EGC-1

**Range:** Varies **LED:** ●

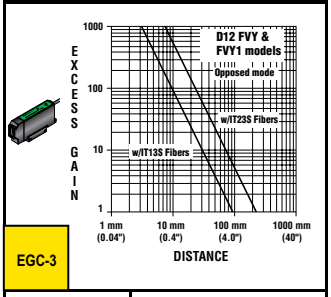
### Diffuse Mode—Glass Fiber D12 Standard




EGC-2

**Range:** Varies **LED:** ●

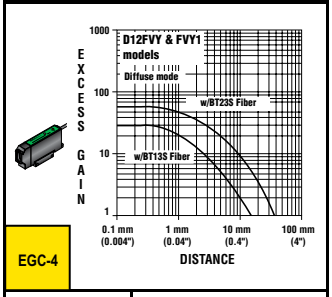
### Opposed Mode—Glass Fiber D12 High Speed




EGC-3

**Range:** Varies **LED:** ●

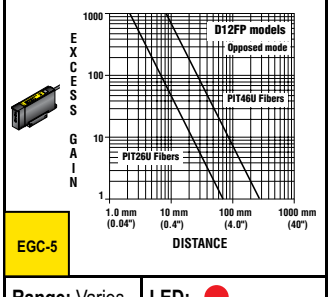
### Diffuse Mode—Glass Fiber D12 High Speed




EGC-4

**Range:** Varies **LED:** ●

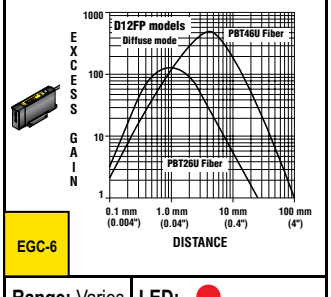
### Opposed Mode—Plastic Fiber D12 Standard




EGC-5

**Range:** Varies **LED:** ●

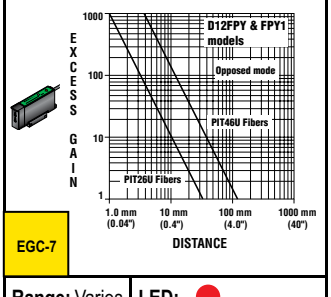
### Diffuse Mode—Plastic Fiber D12 Standard




EGC-6

**Range:** Varies **LED:** ●

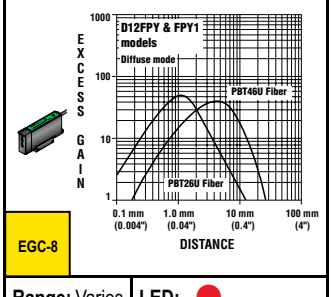
### Opposed Mode—Plastic Fiber D12 High Speed




EGC-7

**Range:** Varies **LED:** ●

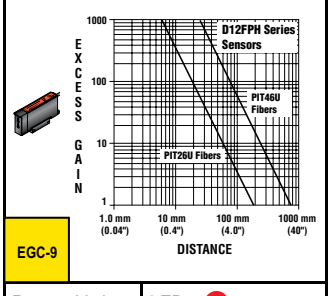
### Diffuse Mode—Plastic Fiber D12 High Speed




EGC-8

**Range:** Varies **LED:** ●

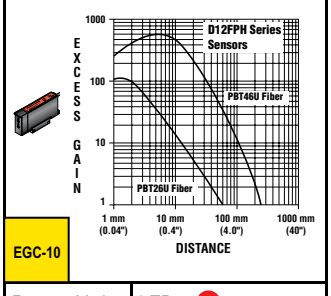
### Opposed Mode—Plastic Fiber D12 High Power




EGC-9

**Range:** Varies **LED:** ●

### Diffuse Mode—Plastic Fiber D12 High Power




EGC-10

**Range:** Varies **LED:** ●

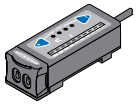
SENSORS

# R55F
## Glass or Plastic Fiber Optic Sensors

- Delivers outstanding color contrast sensitivity
- Features innovative TEACH function with two options for setting the sensing threshold
- Reliably detects 16 levels of grayscale at up to 10,000 actuations per second
- Available in two fiber types: economical plastic for repeated flexing and glass for harsh conditions
- Easily mounts in confined areas, either flat or to 35 mm DIN rail
- Provides bipolar (NPN/PNP) outputs with delay settings of 0, 20 and 40 milliseconds
- Clearly displays relative received signal strength with 10-element indicator bargraph

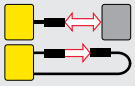
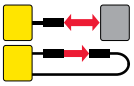
ACCESSORIES page 238
PLASTIC FIBERS PAGE 239
GLASS FIBERS PAGE 256
PLASTIC FIBER
GLASS FIBER


**ONLINE**
AUTOCAD, STEP, IGES & PDF



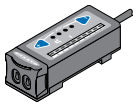
## R55F Fiber Optic, 10-30V dc

Infrared LED  Visible Red LED

| Sensing Mode/LED | Range | Connection | Output Type | Models |
|---|---|---|---|---|
|  GLASS FIBER | Range varies by sensing mode and fiber optics used. | 2 m | Bipolar NPN/PNP | R55F |
| | | 5-pin Euro QD | | R55FQ |
|  GLASS FIBER | | 2 m | | R55FV |
| | | 5-pin Euro QD | | R55FVQ |

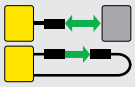
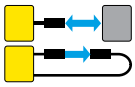
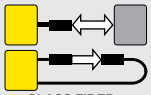
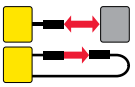
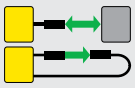
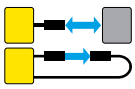
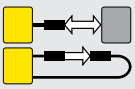
**Connection options:** A model with a QD requires a mating cordset (see page 238).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **R55F W/30**).



# R55F Fiber Optic, 10-30V dc

Visible Green LED | Visible Blue LED | Visible White LED | Visible Red LED

| Sensing Mode/LED | Range | Connection | Output Type | Models |
|---|---|---|---|---|
|  GLASS FIBER | Range varies by sensing mode and fiber optics used. | 2 m | Bipolar NPN/PNP | R55FVG |
| | | 5-pin Euro QD | | R55FVGQ |
|  GLASS FIBER | | 2 m | | R55FVB |
| | | 5-pin Euro QD | | R55FVBQ |
|  GLASS FIBER | | 2 m | | R55FVW |
| | | 5-pin Euro QD | | R55FVWQ |
|  PLASTIC FIBER | | 2 m | | R55FP |
| | | 5-pin Euro QD | | R55FPQ |
|  PLASTIC FIBER | | 2 m | | R55FPG |
| | | 5-pin Euro QD | | R55FPGQ |
|  PLASTIC FIBER | | 2 m | | R55FPB |
| | | 5-pin Euro QD | | R55FPBQ |
|  PLASTIC FIBER | | 2 m | | R55FPW |
| | | 5-pin Euro QD | | R55FPWQ |

**Connection options:** A model with a QD requires a mating cordset (see page 238).

For 9 m cable, add suffix **W/30** to the 2 m model number (example, **R55F W/30**).

## R55F Fiber Optic Specifications

| | |
|---|---|
| **Supply Voltage and Current** | 10 to 30V dc (10% max. ripple) at less than 70 mA, exclusive of load |
| **Supply Protection Circuitry** | Protected against reverse polarity and transient voltages |
| **Output Configuration** | **Bipolar:** One current sourcing (PNP) and one current sinking (NPN) open-collector transistor |
| **Output Rating** | 150 mA max each output @ 25° C (derate ≈ 1 mA per ° C increase)<br>**OFF-state leakage current:** less than 5 µA @ 30V dc<br>**ON-state saturation voltage: PNP:** less than 1V @ 10 mA; 1.5V @ 150 mA<br>**NPN:** less than 200 mV @ 10 mA; 1V @ 150 mA |
| **Output Protection Circuitry** | Protected against false pulse on power-up and continuous overload or short-circuit of outputs |
| **Output Response Time** | 50 microseconds |
| **Delay at Power-up** | 100 milliseconds; outputs do not conduct during this time. |

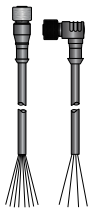
More on next page

## R55F Fiber Optic Specifications

| | |
|---|---|
| **Adjustments** | **Using push buttons ("+" Dynamic and "-" Static):**<br>Manually adjust Switch Point using "+" or "-" buttons<br>Dynamic TEACH (teach on-the-fly) sensitivity adjustment<br>Static TEACH sensitivity adjustment<br>Static Single-Point TEACH<br>Light operate/Dark operate<br>OFF-Delay select: 0 milliseconds, 20 milliseconds or 40 milliseconds<br><br>**Using Remote TEACH input (gray wire):**<br>Dynamic TEACH (teach on-the-fly) sensitivity adjustment<br>Static TEACH sensitivity adjustment<br>Static Single-Point TEACH<br>Light operate/Dark operate<br>OFF-Delay select: 0 milliseconds, 20 milliseconds or 40 milliseconds<br>Push button lockout for security |
| **Indicators** | 10-segment (Green) light bar indicates signal strength<br>Light Operate (Green)<br>Dark Operate (Green)<br>Outputs Conducting (Yellow)<br>OFF-Delay (Green):<br>**SETUP Mode:** OFF–no delay<br>Flashing–20 milliseconds delay<br>ON–40 milliseconds delay<br>**RUN Mode:** OFF–no delay<br>ON–20 or 40 milliseconds delay |
| **Construction** | Black ABS/polycarbonate blend; nylon fiber clip mounts to standard 35 mm DIN rail. 1 stainless steel right angle bracket and 1 PBT polyester bracket for mounting to flat surfaces also included with sensor. |
| **Environmental Rating** | IEC IP67; NEMA 6 |
| **Connections** | 2 m or 9 m PVC-jacketed 5-conductor cable, or 5-pin Euro-style quick-disconnect (QD) fitting. QD cordsets are ordered separately. See page 238.<br>**Fibers:** Fiber clip (no tool required) |
| **Operating Conditions** | **Temperature:** -10° to +55° C<br>**Relative humidity:** 90% at 50° C (non-condensing) |
| **Application Notes** | • Do not mount the fiber tip directly perpendicular to shiny surfaces; position it at approximately a 15° angle in relation to the sensing target.<br>• Minimize web or product "flutter" whenever possible to maximize sensing reliability. |
| **Certifications** | CE |
| **Hookup Diagrams** | DC08 (p. 717) |

## Cordsets

| Euro QD | | |
|---|---|---|
| See page 661 | | |
| | Threaded 5-Pin | |
| Length | Straight | Right-Angle |
| 2 m | MQDC1-506 | MQDC1-506RA |
| 5 m | MQDC1-515 | MQDC1-515RA |
| 9 m | MQDC1-530 | MQDC1-530RA |

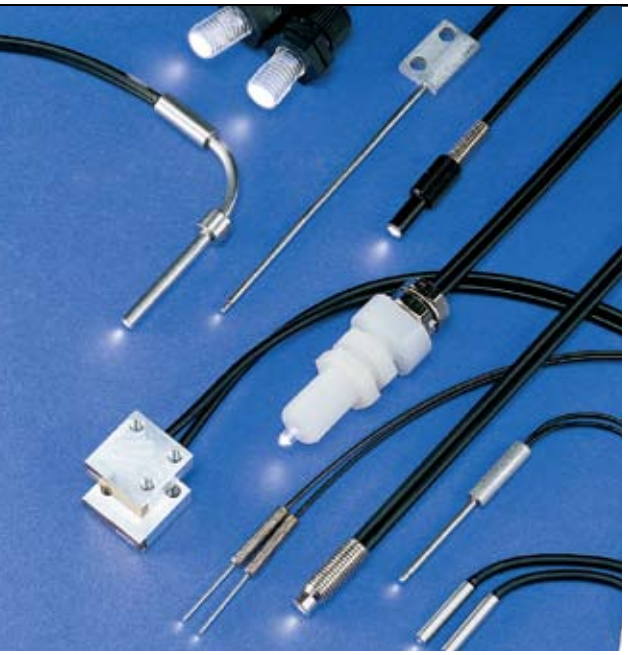


Additional cordset information available. See page 655.

## Brackets

| R55F | | |
|---|---|---|
|  |  |  |
| pg. 608 | pg. 650 | pg. 650 |
| DIN-35... | SMBR55F01 | SMBR55FRA |

Additional bracket information available. See page 601



# Plastic Fiber Optics

- Provide an economical alternative to glass fiber optics for piping photoelectric sensing light to and from confined areas with suitable environments
- Ideal for detecting small objects
- Withstand repeated flexing and bending
- Available in individual or bifurcated styles*
- Available with optional DURA-BEND™ fibers for improved flexibility in difficult-to-access locations, without the decreased performance to which excessively bent standard plastic fibers optics are prone
- Available with core diameters of 0.25, 0.50, 0.75, 1.0 and 1.5 mm



## Plastic Fiber Optic Model Key

| P | B | P | 4 | 6 | U | C | X |
|---|---|---|---|---|---|---|---|

**PLASTIC FIBER FAMILY designator**

Same for all plastic fibers

**ASSEMBLY STYLE designator**

**B** = Bifurcated fiber
**I** = Individual fiber*
**DI** = Dual Individual fiber*

**SENSING END designator**

**A** = 90° Angle
**AT** = 90° Angle/Thread
**CF** = Coaxial Ferrule
**CT** = Coaxial Thread
**E** = Encapsulated
**EFP** = Extended Ferrule Probe
**F** = Ferrule
**FM** = Ferrule Miniature
**FMP** = Ferrule Miniature Probe
**L** = Lensed
**P** = Probe
**PF** = Probe Ferrule
**PMSB** = Probe Miniature Side-view Bendable
**PS** = Probe Side-view
**PSB** = Probe Side-view Bendable
**PSM** = Probe Side-view Miniature
**R** = Rectangular
**RS** = Rectangular Side-view
**T** = Thread
**TA** = Thread/90° Angle
**TP** = Thread/Probe

**FIBER CORE DIAMETER designator**

**1** = 0.25 mm
**2** = 0.50 mm
**3** = 0.75 mm
**4** = 1.00 mm
**6** = 1.50 mm
**1X4** = 4 x 0.25 mm
**1X16** = 16 x 0.265 mm
**1X32** = 32 x 0.265 mm

**FIBER LENGTH designator**

**3** = 1 m (1000 mm)
**6** = 2 m (2000 mm)
**100** = 30 m (30480 mm)

**CONTROL END designator**

**T5** = Terminated
**TMB5** = STEELSKIN™ braiding over monocoil reinforcement
**U** = Unterminated straight cable**
**UC** = Unterminated Coiled cable
**UHF** = Unterminated DURA-BEND™ multi-core cable

**MODIFICATIONS designator**

"MXX" = Sensing end tip modification



* All individual plastic fiber optics are sold and used in pairs. Bifurcated fibers are two-way fibers with a single sensing end that both emits and receives light and with dual-control sensor ends that attach separately to the sensor's LED and photodetector.

** Plastic fibers with "U" in the suffix of the model numbers have unterminated control ends; cut them to the required length using the supplied cutter.

## Plastic Fiber Optics Specifications

| | |
|---|---|
| **Construction** | **Optical Fiber:** acrylic (PMMA) monofilament, except as noted<br>**Protective Jacket:** black polyethylene, except as noted<br>**Threaded End Tips and Hardware:** nickel-plated brass, except as noted<br>**Probe End Tips:** annealed (bendable) 304 stainless steel<br>**Angled End tips:** hardened 304 stainless steel<br>**Ferrule End Tips:** 303 stainless steel |
| **Sensing Range** | Refer to the specific fiber optic/sensor combination |
| **Implied Dimensional Tolerance** | **All dimensions are in millimeters:** x = ±2.5 mm, x.x = ±0.25 mm and x.xx = ±0.12 mm, unless specified.<br>"L" = ±40 mm per meter |
| **Minimum Bend Radius** | 8 mm for 0.25 mm diameter fibers<br>12 mm for 0.5 mm diameter fibers (except DURA-BEND™)<br>25 mm for 1.0 mm diameter fibers (except DURA-BEND™)<br>38 mm for 1.5 mm diameter fibers |
| **Repeat Bending/Flexing** | Life expectancy of plastic fiber optic cable is in excess of one million cycles at bend radii of no less than the minimum and a bend of 90° or less. Avoid stress at the point where the cable enters the sensor ("control end") and at the sensing end tip. Coiled plastic fiber optic assemblies are recommended for any application requiring reciprocating fiber motion. |
| **Chemical Resistance** | The acrylic core of the monofilament optical fiber will be damaged by contact with acids, strong bases (alkalis) and solvents. The polyethylene jacket will protect the fiber from most chemical environments. However, materials may migrate through the jacket with long term exposure. Samples of fiber optic material are available from Banner for testing and evaluation. |
| **Temperature Extremes** | Temperatures below -30° C will cause embrittlement of the plastic materials but will not cause transmission loss. Temperatures above +70° C will cause both transmission loss and fiber shrinkage. |
| **Operating Temperature** | -30° to +70° C, unless otherwise specified |

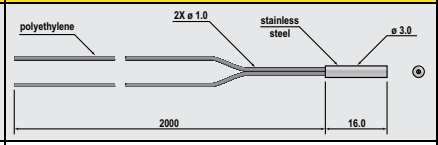
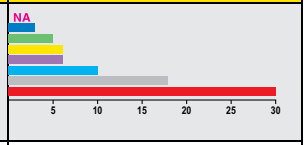
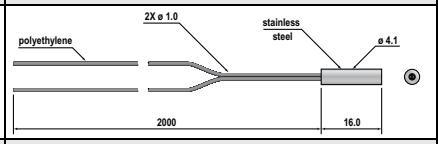
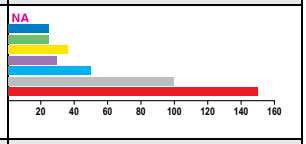
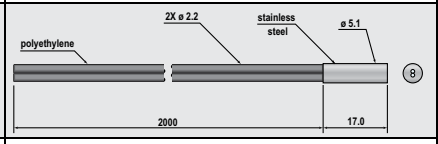
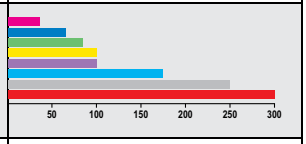
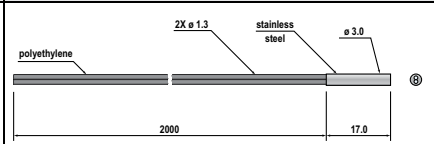
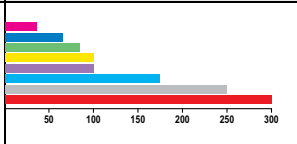
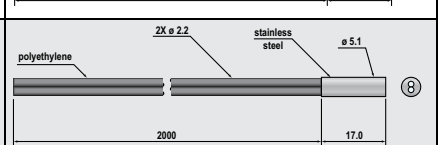
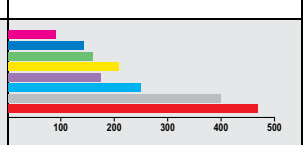
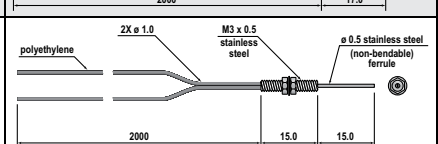
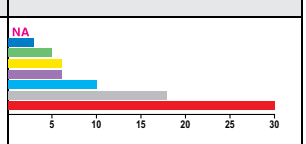
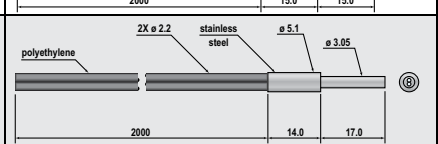
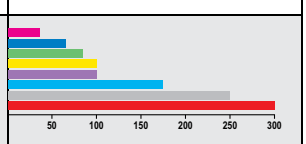
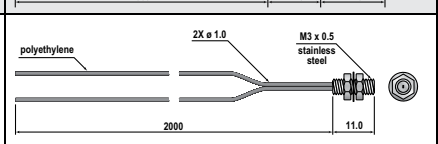
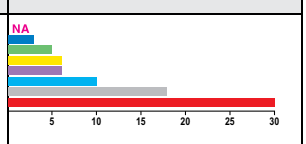
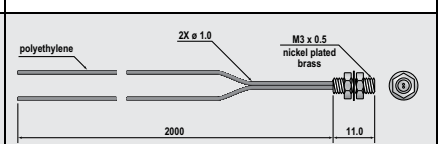
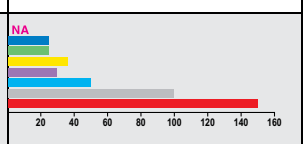
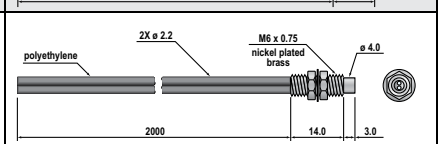
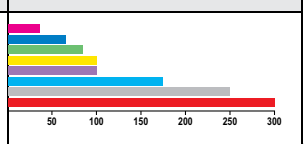
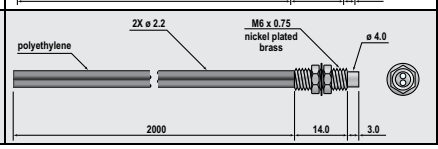
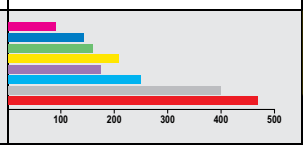
### ⚠ Application Notes and Warnings ⚠

1. Plastic fiber assemblies with "U" in the suffix of the model numbers have unterminated control ends (the end that is coupled to the photoelectric sensor). The customer can cut these fiber optic assemblies to the required length using the supplied cutter. Use only the supplied cutter to ensure optimal light coupling efficiency.
2. Terminated plastic fiber assemblies are optically ground and polished and cannot be shortened, spliced or otherwise modified.
3. Do not subject the plastic fibers to sharp bends, pinching, high tensile loads or high levels of radiation.
4. When ordering fiber lengths in excess of 2 m, take into account light signal attenuation due to the additional length.
5. Due to their light transmission properties, plastic fiber optics are recommended for use only with visible light fiber optic sensors.
6. Use caution when applying fiber optics in hazardous locations. Although fiber optic assemblies are, by themselves, intrinsically safe, the sensor and associated electronics must be LOCATED IN A SAFE ENVIRONMENT. Alternatively, fiber optics may be used with NAMUR sensor model Q45AD9FP (page 196). Fiber optics do not necessarily provide a hermetic seal between a hazardous environment and the safe environment.







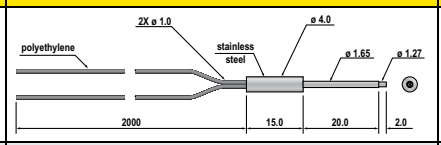
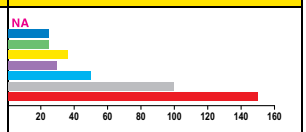
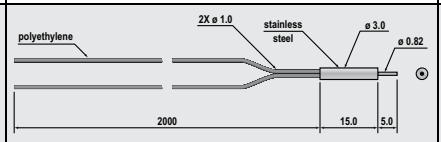
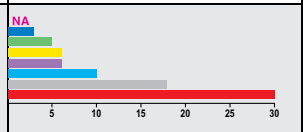
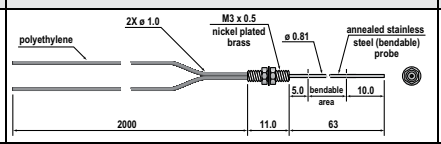
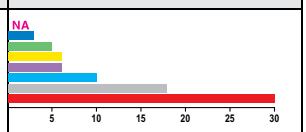
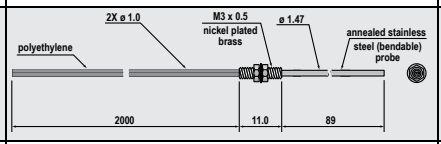
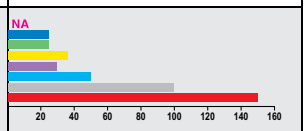
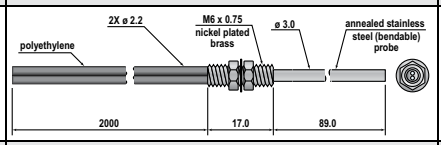
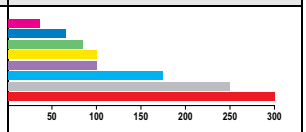
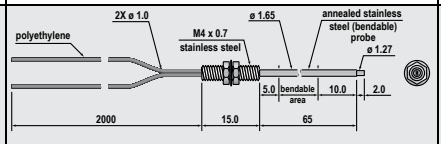
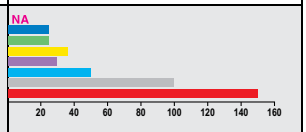
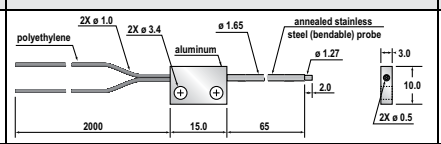
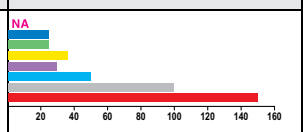
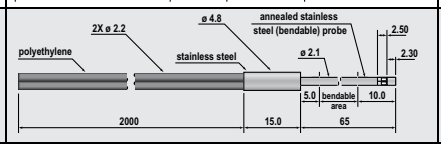
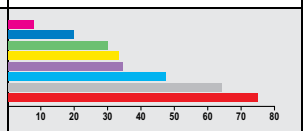
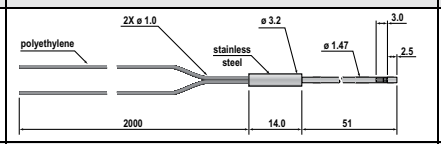
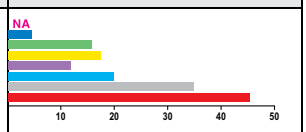
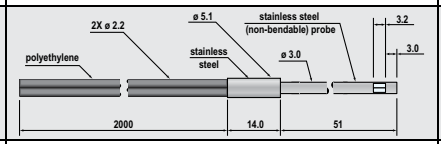
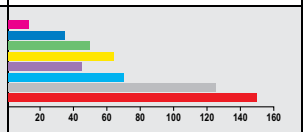
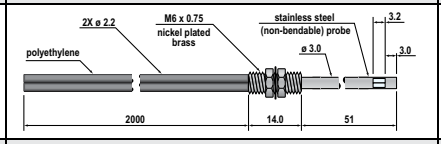
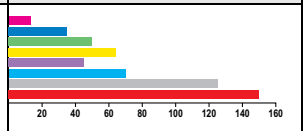
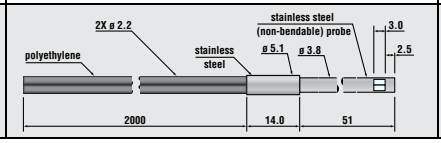
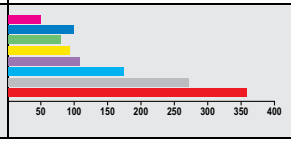

| Model Number | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|
| Diffuse / Standard | PBF16U |  | 0.25 | 8 | • Smooth ferrule | ✓ |  |
| | PBF26U |  | 0.5 | 12 | • Smooth ferrule | ✓ |  |
| | PBF46U |  | 1.0 | 25 | • Smooth ferrule | ✓ |  |
| | PBF46UM3MJ1.3 |  | 1.0 | 25 | • Smooth ferrule; thin jacket (ø 1.3) | ✓ |  |
| | PBF66U |  | 1.5 | 38 | • Smooth ferrule; long range | ✓ |  |
| | PBFM16U |  | 0.25 | 8 | • Non-bendable miniature tip | ✓ |  |
| | PBFM46U |  | 1.0 | 25 | • Smooth ferrule | ✓ |  |
| | PBT16U |  | 0.25 | 8 | • Thread | ✓ |  |
| | PBT26U |  | 0.5 | 12 | • Thread | ✓ |  |
| | PBT46U |  | 1.0 | 25 | • Thread | ✓ |  |
| | PBT66U |  | 1.5 | 38 | • Thread; long range | ✓ |  |

More on next page

NA: WORLD-BEAM QS18 not recommended.

* Fibers can be free cut using fiber cutter (see page 255).

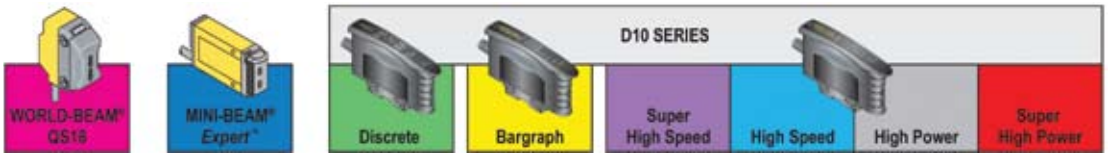



| Model Number | | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|---|
| Diffuse | Probe | PBEFP26U |  | 0.5 | 12 | • Smooth ferrule; non-bendable tip | ✓ |  |
| | | PBFMP16UMP2 |  | 0.25 | 8 | • Smooth ferrule; non-bendable tip | ✓ |  |
| | | PBP16U |  | 0.25 | 8 | • Thread; bendable tip | ✓ |  |
| | | PBP26U |  | 0.5 | 12 | • Thread; bendable tip | ✓ |  |
| | | PBP46U |  | 1.0 | 25 | • Thread; bendable tip | ✓ |  |
| | | PBPF26U |  | 0.5 | 12 | • Thread; bendable tip | ✓ |  |
| | | PBPF26UMB |  | 0.5 | 12 | • Flat mounting block; bendable tip | ✓ |  |
| | Side-View | PBPMSB36U |  | 0.75 | 20 | • Smooth ferrule; bendable tip | ✓ |  |
| | | PBPS26U |  | 0.5 | 12 | • Smooth ferrule; bendable tip | ✓ |  |
| | | PBPS46U |  | 1.0 | 25 | • Smooth ferrule; bendable tip | ✓ |  |
| | | PBPS46UMT |  | 1.0 | 25 | • Thread; non-bendable tip | ✓ |  |
| | | PBPS66U |  | 1.5 | 38 | • Smooth ferrule; non-bendable tip | ✓ |  |

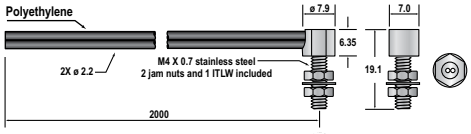
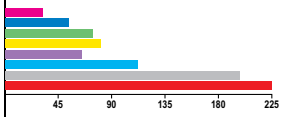
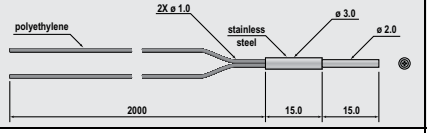
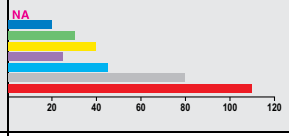
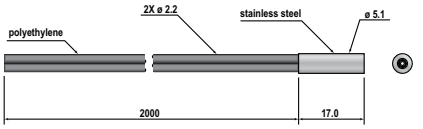
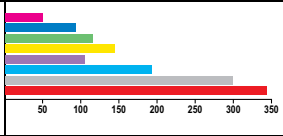
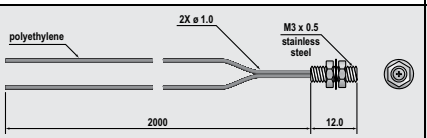
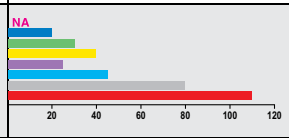
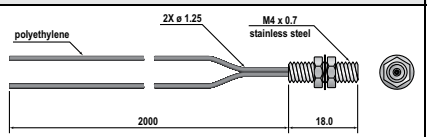
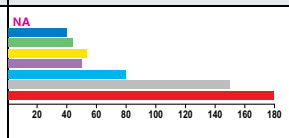
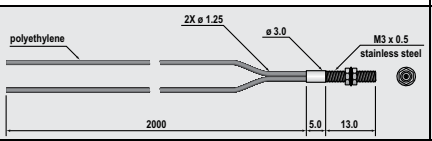
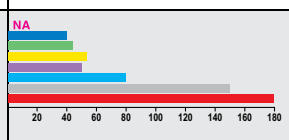
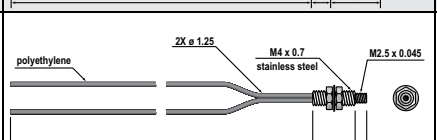
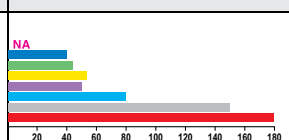
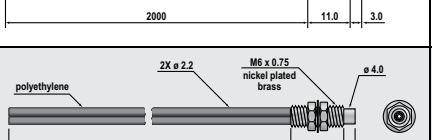
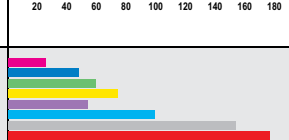
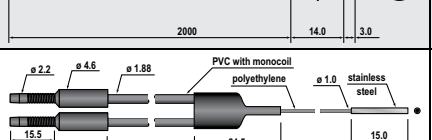
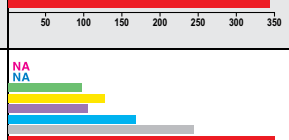
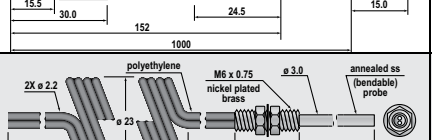
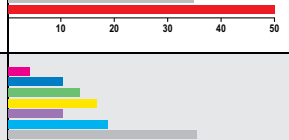
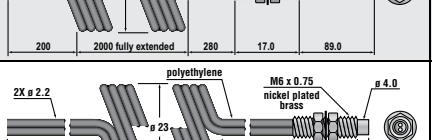
More on next page

**NA:** WORLD-BEAM QS18 not recommended.

* Fibers can be free cut using fiber cutter (see page 255).





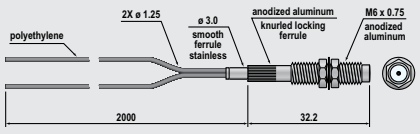
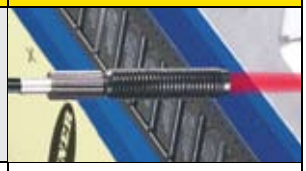
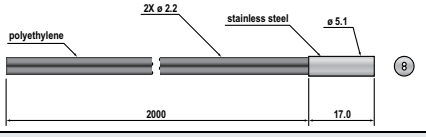
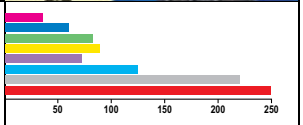
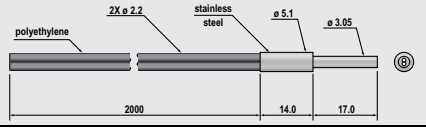
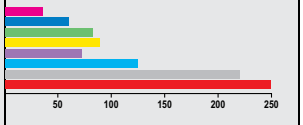
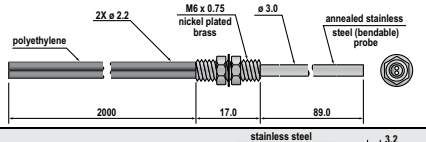
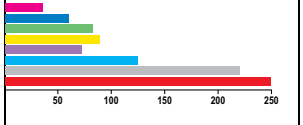
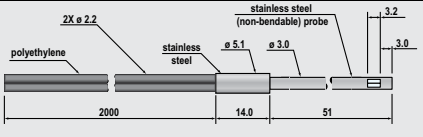
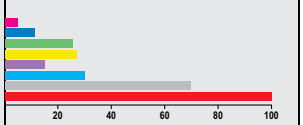
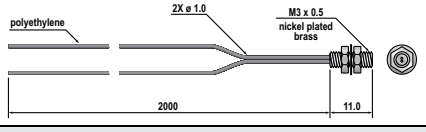
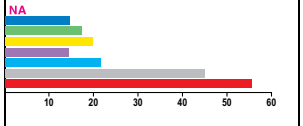
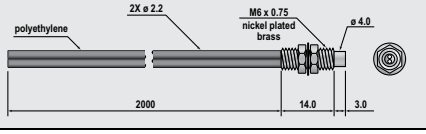
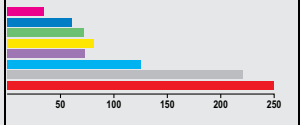
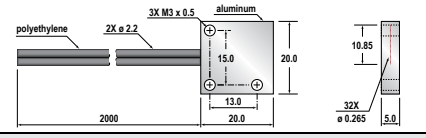
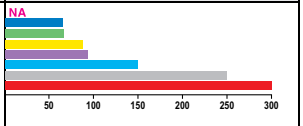
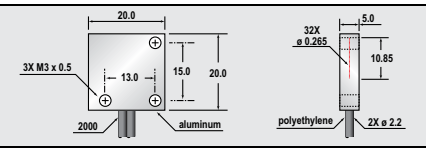
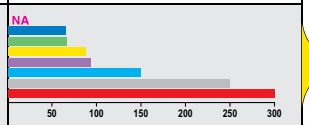

| Model Number | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|
| Diffuse / Right-Angle | PBAT46UHFMTA |  | 1.0 | 2 | • Right Angle, threaded, stainless steel | ✓ |  |
| Diffuse / Coaxial | PBCF21X46U |  | 0.5<br>4X 0.25 | 12 | • Miniature probe tip | ✓ |  |
| Diffuse / Coaxial | PBCF46U |  | 1.0<br>16X 0.265 | 25 | • Smooth ferrule | ✓ |  |
| Diffuse / Coaxial | PBCT21X46U |  | 0.5<br>4X 0.25 | 12 | • Miniature thread | ✓ |  |
| Diffuse / Coaxial | PBCT26U |  | 0.5<br>9X 0.25 | 12 | • Thread | ✓ |  |
| Diffuse / Coaxial | PBCT26UM3 |  | 0.5<br>9X 0.25 | 12 | • Miniature thread | ✓ |  |
| Diffuse / Coaxial | PBCT26UM4M2.5 |  | 0.5<br>9X 0.25 | 12 | • Thread | ✓ |  |
| Diffuse / Coaxial | PBCT46U |  | 1.0<br>16X 0.265 | 25 | • Thread | ✓ |  |
| Diffuse / High-Flex | PBFM1X43T5 |  | 4X 0.25 | 8 | • Best for repetitive flexing (1,000s of cycles) | |  |
| Diffuse / High-Flex | PBP46UC |  | 1.0 | 25 | • For applications involving reciprocating motion | ✓ |  |
| Diffuse / High-Flex | PBT46UC |  | 1.0 | 25 | • For applications involving reciprocating motion | ✓ |  |

More on next page

**NA:** WORLD-BEAM QS18 not recommended. **NA:** MINI-BEAM *Expert* not recommended. Indicates lens available for model. See page 247 for details.

* Fibers can be free cut using fiber cutter (see page 255).




| Model Number | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|
| Diffuse — Convergent Beam Spot | PLI-A10 |   | 0.5 9X 0.25 | 12 | • Anodized AL tip; ø 0.5-3.2 mm beam spot<br>• Glass lens | ✓ |  |
| Diffuse — DURA-BEND™ | PBF46UHF |   | 1.0 | 1 | • Smooth ferrule | ✓ |   |
| | PBFM46UHF |   | 1.0 | 1 | • Smooth ferrule | ✓ |   |
| | PBP46UHF |   | 1.0 | 1 | • Thread; bendable tip | ✓ |   |
| | PBPS46UHF |   | 1.0 | 1 | • Smooth ferrule; non-bendable tip | ✓ |   |
| | PBT26UHF |   | 0.5 | 1 | • Thread | ✓ |   |
| | PBT46UHF |   | 1.0 | 1 | • Thread | ✓ |   |
| Area Sensing (Array) | PBR1X326U |   | 32X 0.265 | 25 | • Rectangular tip | ✓ |   |
| | PBRS1X326U |   | 32X 0.265 | 25 | • Rectangular tip; side sensing | ✓ |   |

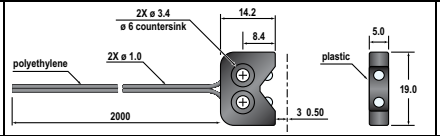
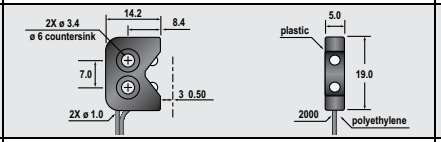
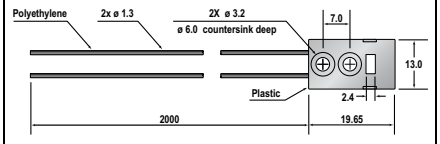
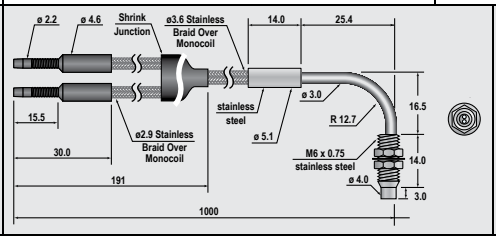
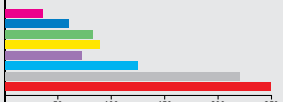
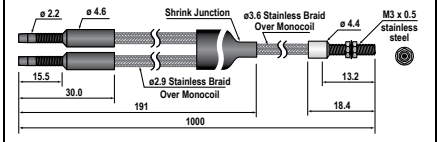
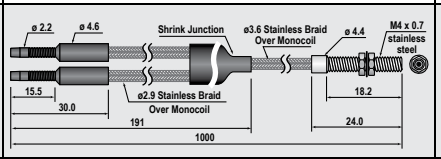
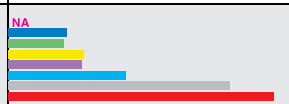
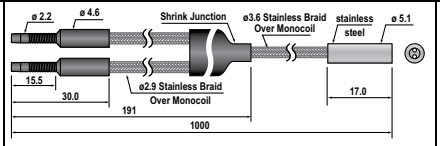
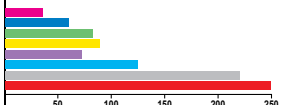
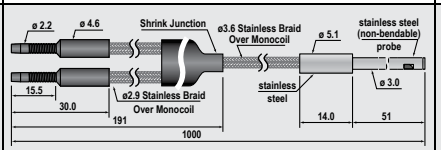
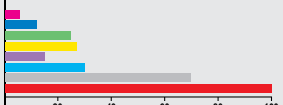
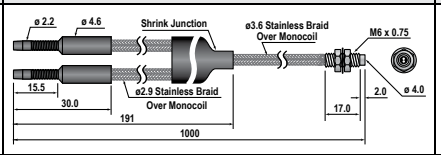
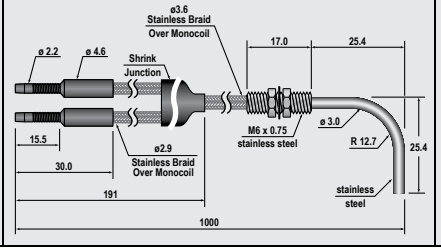
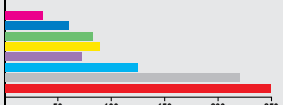
More on next page

**NA:** WORLD-BEAM QS18 not recommended.

* Fibers can be free cut using fiber cutter (see page 255).






| Model Number | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|
| Mechanical Convergent | P22-C1 |  | 0.5 | 12 | • Straight exit with lenses; 3 mm range; DURA-BEND fiber | ✓ |  |
| | P12-C1 |  | 0.5 | 12 | • Side exit with lenses; 3 mm range; DURA-BEND fiber | ✓ | |
| | P32-C6 |  | 1.0 | 25 | • Flat mount; 6 mm range; lensed convergent optics | ✓ |  |
| Diffuse — SteelSkin™ | PBAT43TMB5 |  | 1.0 | 12 | • 90° angle/thread | |  |
| | PBCT23TMB5 |  | 0.5<br>9X 0.25 | 12 | • Miniature thread | |  |
| | PBCT23TMB5M4 |  | 0.5<br>9X 0.25 | 12 | • Thread | |  |
| | PBF43TMB5 |  | 1.0 | 12 | • Smooth ferrule | |  |
| | PBPS43TMB5 |  | 1.0 | 12 | • Smooth ferrule; non-bendable tip | |  |
| | PBT43TMB5 |  | 1.0 | 12 | • Thread | |  |
| | PBTA43TMB5 |  | 1.0 | 12 | • Thread/90° angle | |  |

More on next page



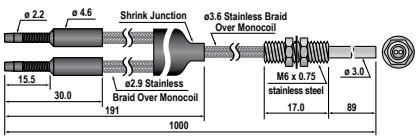
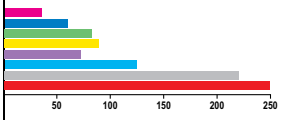
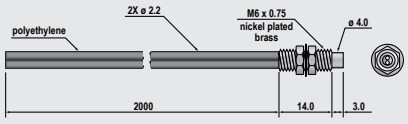
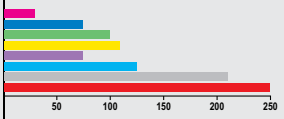
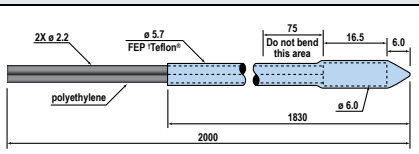
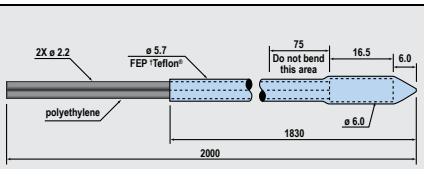
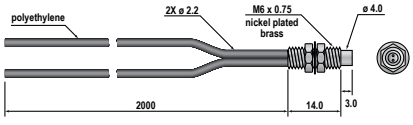
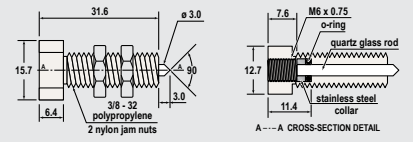
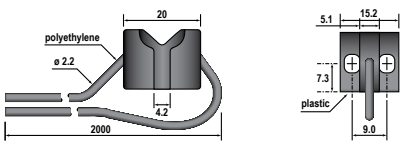
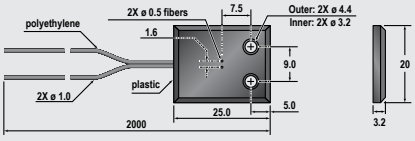
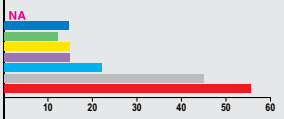
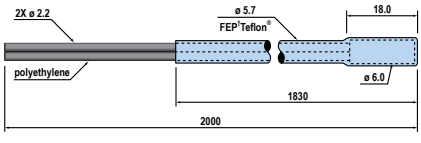
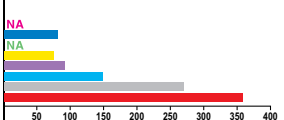
NA: WORLD-BEAM QS18 not recommended.

Indicates lens available for model. See page 247 for details.

* Fibers can be free cut using fiber cutter (see page 255).

SENSORS




| Model Number | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|
| Diffuse — Liquid Level | SteelSkin™ PBTP43TMB5 |  | 1.0 | 12 | • Thread; bendable tip | |  |
| | High-Temp PBT46UHT1 |  | 1.0 | 25 | • Thread; withstands 105° C | ✓ |  |
| | PBE46UTMLLP |  | 1.0 | 25 | • Fluoropolymer encapsulated<br>• Sensor switches when tip of fiber is immersed in liquid | ✓ |  |
| | PBE46UTMLLPHT1 |  | 1.0 | 25 | • Fluoropolymer encapsulated; withstands 105° C<br>• Sensor switches when tip of fiber is immersed in liquid | ✓ | |
| | PBT26UM6M.1 |  | 0.5 | 12 | • Quartz probe; polypropylene housing<br>• Sensor switches when tip of quartz is immersed in liquid | ✓ |  |
| | TGR3/8MPFMQ |  | 0.5 | 12 | | | |
| | PDI46U-LLD |  | 1.0 | 1 | • Clear tube mount; DURA-BEND fiber<br>• Sensor switches when liquid meniscus reaches optical axis | ✓ |  |
| | Flat Pack PBRS26U |  | 0.5 | 12 | • 3.2 mm thickness; DURA-BEND fiber | ✓ |  |
| | Chemical Resistant PBE46UTMNL |  | 1.0 | 25 | • Fluoropolymer encapsulated tip | ✓ |  |

More on next page

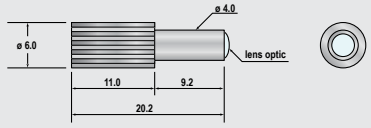
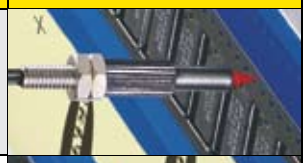
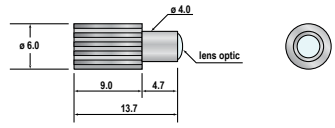
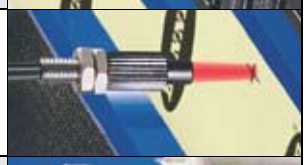
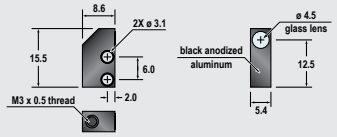
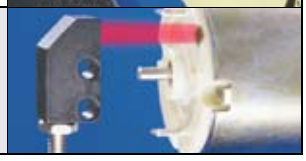
NA: WORLD-BEAM QS18 not recommended.

NA: D10–Discrete not recommended.

* Fibers can be free cut using fiber cutter (see page 255).

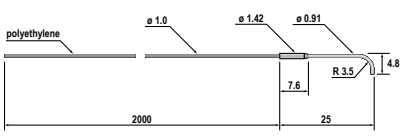
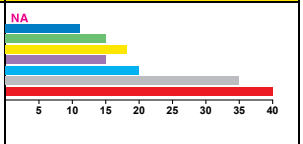
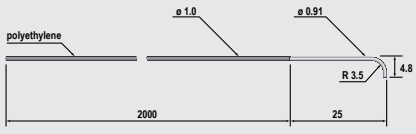
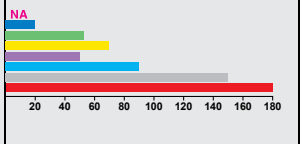
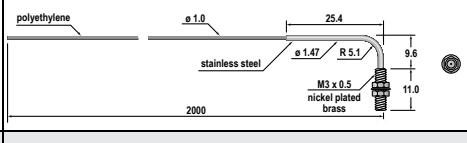
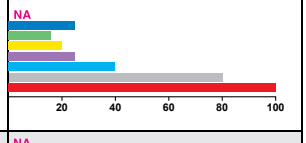
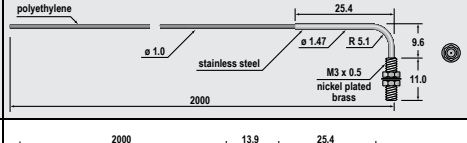
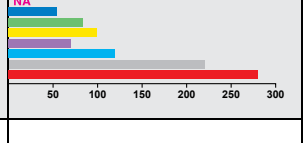
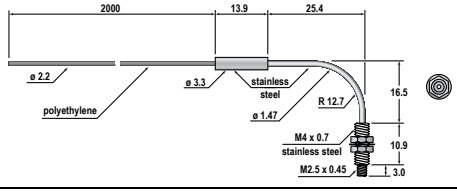
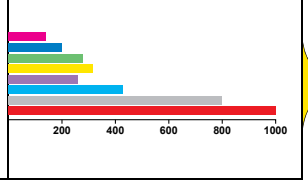



Photoelectrics Sensors
Fiber Optic Sensors
Special Purpose Sensors
Measurement & Inspection Sensors
Vision
Wireless
Indicators
Safety Light Screens
Safety Laser Scanners
Fiber Optic Safety Systems
Safety Controllers & Modules
Safety Two-Hand Control Modules
Safety Interlock Switches
Emergency Stop Devices

| Model Number | | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|---|
| Diffuse | Convergent Spot Lens | L4C6 |  | ref. model PBCT26U | ref. model PBCT26U | • Anodized AL housing; ø 0.25 mm beam spot @ 6 mm<br>• Fixed focus | |  |
| | | L4C20 |  | ref. model PBCT26U | ref. model PBCT26U | • Anodized AL housing; ø 4 mm beam spot @ 20 mm<br>• Fixed focus | |  |
| | | LZ3C8 |  | ref. model PBT26UM3 | ref. model PBCT26UM3 | • Anodized AL housing; ø 0.5 - 3.2 mm adj. beam spot<br>• Adjustable focus | |  |




FIBER SENSORS
PLASTIC FIBERS
GLASS FIBERS

| Model Number | | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|---|
| Opposed | Standard | PIA16U |  | 0.25 | 8 | • 90° angle | ✓ |  |
| | | PIA26U |  | 0.5 | 12 | • 90° angle | ✓ |  |
| | | PIAT16U |  | 0.25 | 8 | • 90° angle/thread | ✓ |  |
| | | PIAT26U |  | 0.5 | 12 | • 90° angle/thread | ✓ |  |
| | | PIAT46U |  | 1.0 | 25 | • 90° angle/thread | ✓ |  |

More on next page

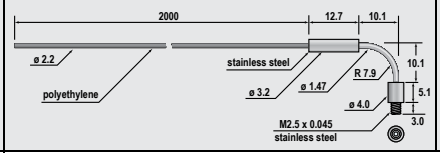
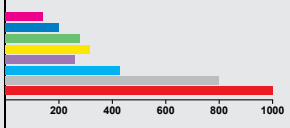
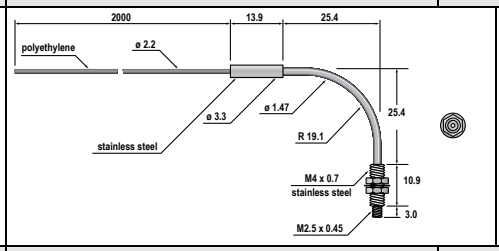
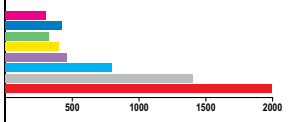
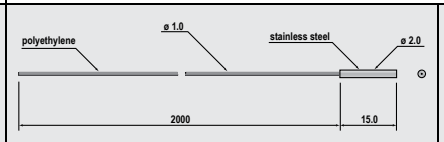
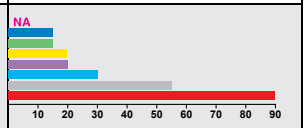
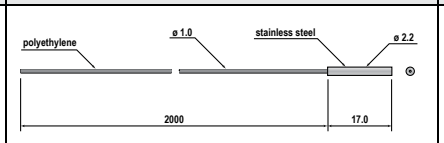
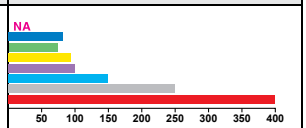
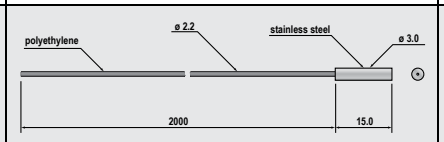
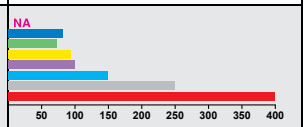
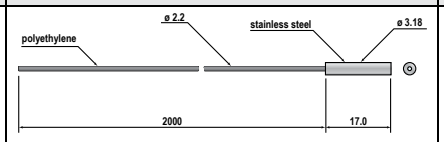
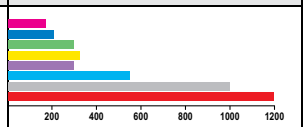
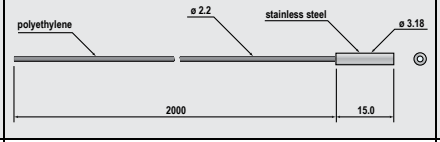
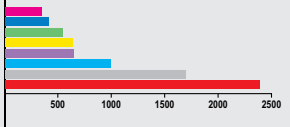
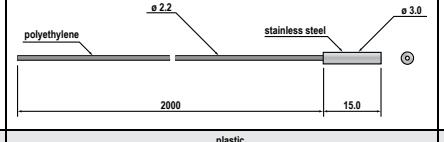
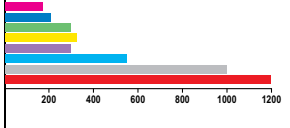
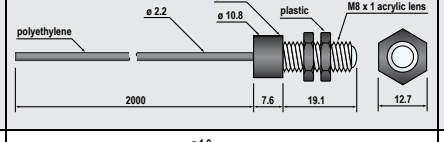
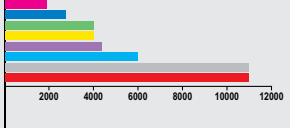
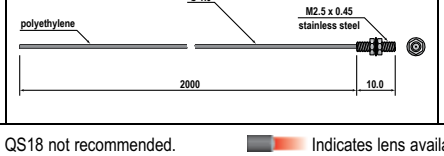
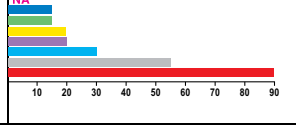
NA: WORLD-BEAM QS18 not recommended.

Indicates lens available for model. See page 253 for details.

* Fibers can be free cut using fiber cutter (see page 255).

SENSORS




| Model Number | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|
| Opposed / Standard | PIAT46UM.4X.4MT |  | 10. | 25 | • 90° angle/thread | ✓ |  |
| | PIAT66U |  | 1.5 | 38 | • 90° angle/thread; long range | ✓ |  |
| | PIF16U |  | 0.25 | 8 | • Smooth ferrule | ✓ |  |
| | PIF26U |  | 0.5 | 12 | • Smooth ferrule | ✓ |  |
| | PIF26UMLS |  | 0.5 | 12 | • Smooth ferrule; thick jacket (ø 2.2 mm) | ✓ |  |
| | PIF46U |  | 1.0 | 25 | • Smooth ferrule | ✓ |  |
| | PIF66U |  | 1.5 | 38 | • Smooth ferrule; long range | ✓ |  |
| | PIFM46U |  | 1.0 | 25 | • Smooth ferrule; miniature tip | ✓ |  |
| | PIL46U |  | 1.0 | 25 | • Plastic lens; ultra-long range<br>• Lens available separately, see page 253. | ✓ |  |
| | PIT16U |  | 0.25 | 8 | • Thread | ✓ |  |

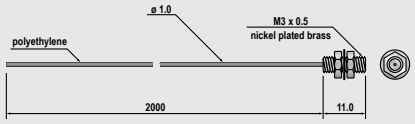
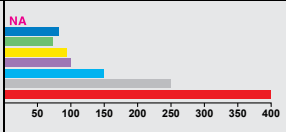
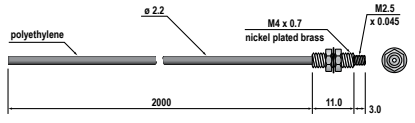
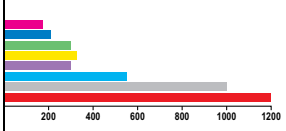
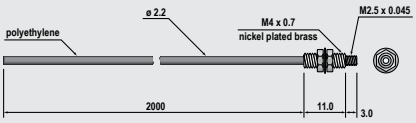
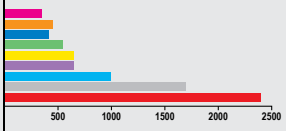
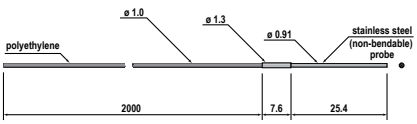
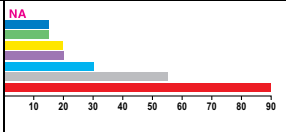
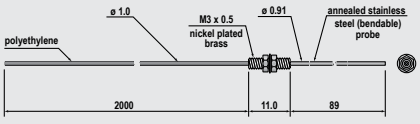
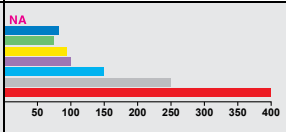
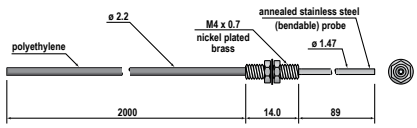
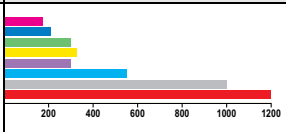
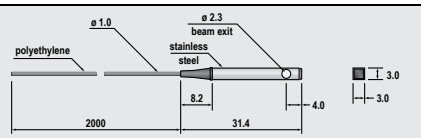
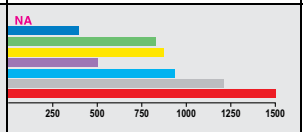
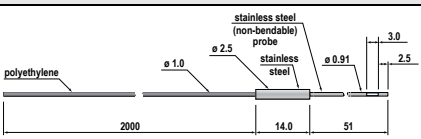
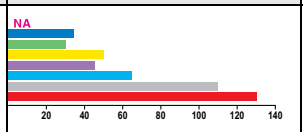
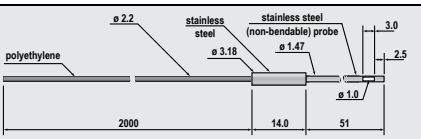
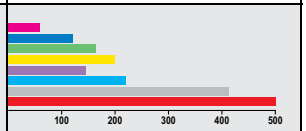
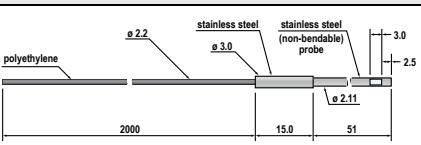
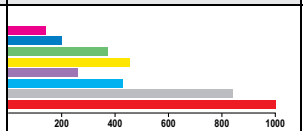
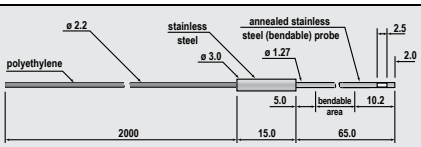
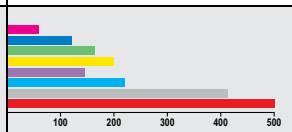
More on next page

**NA:** WORLD-BEAM QS18 not recommended. Indicates lens available for model. See page 253 for details.

* Fibers can be free cut using fiber cutter (see page 255).





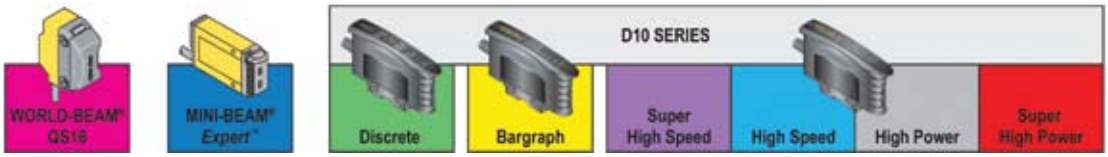

| Model Number | | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|---|
| Opposed | Standard | PIT26U |  | 0.5 | 12 | • Thread | ✓ |  |
| | | PIT46U |  | 1.0 | 25 | • Thread | ✓ |  |
| | | PIT66U |  | 1.5 | 38 | • Thread; long range | ✓ |  |
| | Probe | PIP16U |  | 0.25 | 8 | • Smooth ferrule; non-bendable tip | ✓ |  |
| | | PIP26U |  | 0.5 | 12 | • Thread; bendable tip | ✓ |  |
| | | PIP46U |  | 1.0 | 25 | • Thread; bendable tip | ✓ |  |
| | Side-View | PLIS-1 |  | 0.5 | 12 | • Low beam divergence angle of 2°<br>• Ideal for wafer mapping | ✓ |  |
| | | PIPS26U |  | 0.5 | 12 | • Smooth ferrule; non-bendable tip | ✓ |  |
| | | PIPS46U |  | 1.0 | 25 | • Smooth ferrule; non-bendable tip | ✓ |  |
| | | PIPS66U |  | 1.5 | 38 | • Smooth ferrule; non-bendable tip | ✓ |  |
| | | PIPSB46U |  | 1.0 | 25 | • Smooth ferrule; bendable tip | ✓ |  |

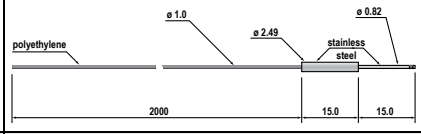
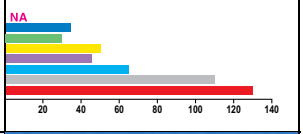
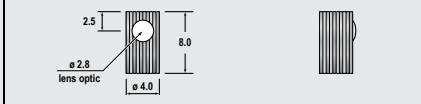
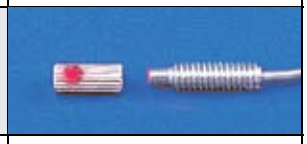
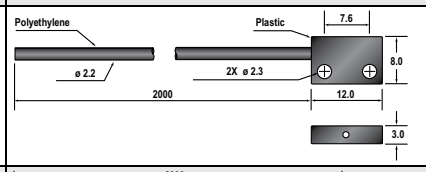
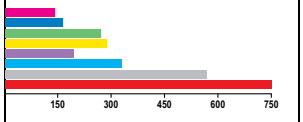
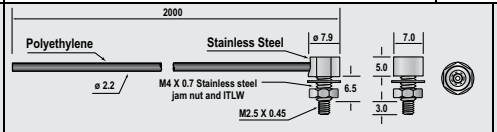
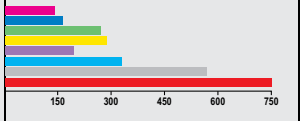
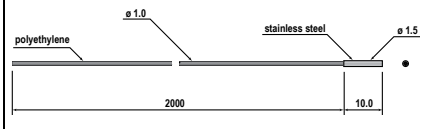
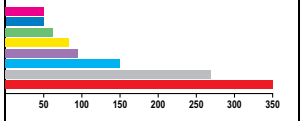
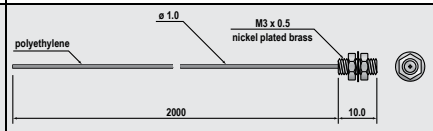
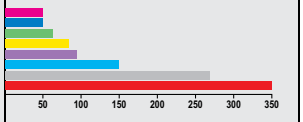
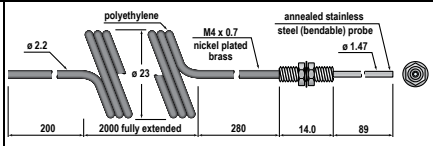
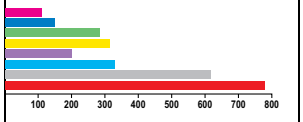
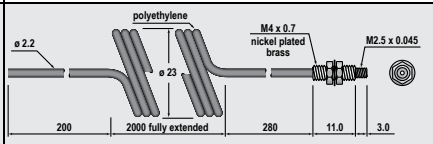
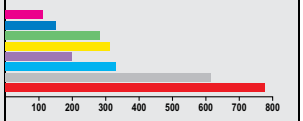
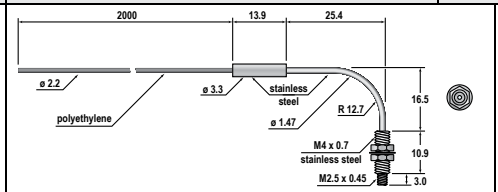
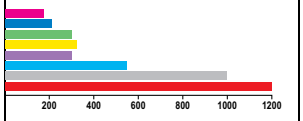
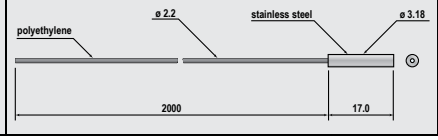
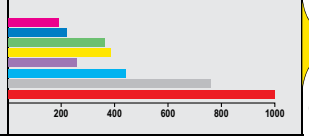
More on next page

**NA:** WORLD-BEAM QS18 not recommended.

* Fibers can be free cut using fiber cutter (see page 255).

SENSORS




| Model Number | | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|---|
| Opposed | Side-View | PIPSM26U |  | 0.5 | 12 | • Miniature smooth ferrule; non-bendable tip | |  |
| | | L2RA |  | ref. model PIT46U | ref. model PIT46U | • Compact glass prism<br>• M2.5 thread | ✓ |  |
| | Right-Angle | PIA46UHFMB8X12 |  | 1.0 | 2 | • Right angle; side exit; Delrin | ✓ |  |
| | | PIAT46UHFMTA |  | 1.0 | 2 | • Right angle; threaded, stainless steel | ✓ |  |
| | High-Flex | PIFM1X46U |  | 4X 0.25 | 8 | • Best for repetitive flexing (1,000s of cycles) | ✓ |  |
| | | PIT1X46U |  | 4X 0.25 | 8 | • Best for repetitive flexing (1,000s of cycles) | ✓ |  |
| | | PIP46UC |  | 1.0 | 25 | • For applications involving reciprocating motion | ✓ |  |
| | | PIT46UC |  | 1.0 | 25 | • For applications involving reciprocating motion | ✓ |  |
| | DURA-BEND™ | PIAT46UHF |  | 1.0 | 1 | • 90° angle/thread | ✓ |  |
| | | PIF46UHF |  | 1.0 | 1 | • Smooth ferrule | ✓ |  |

More on next page

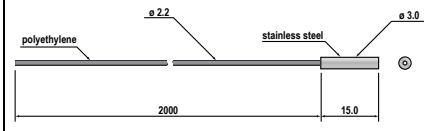
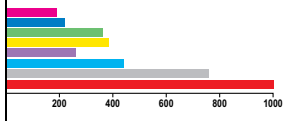
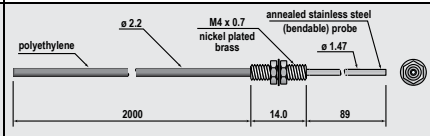
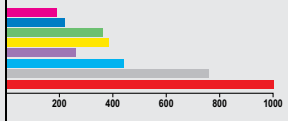
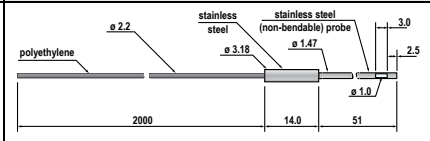
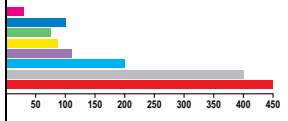
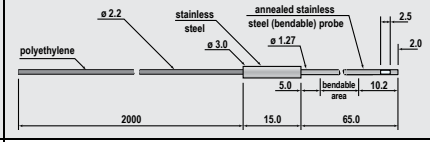
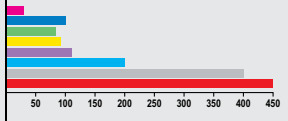
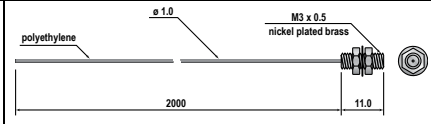
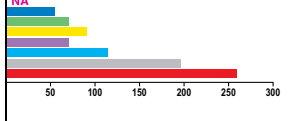
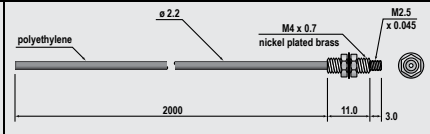
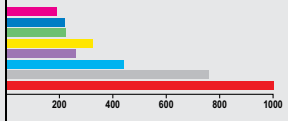
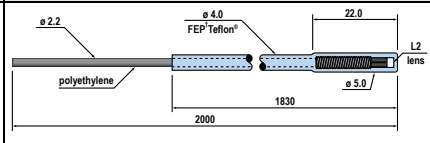
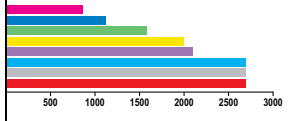
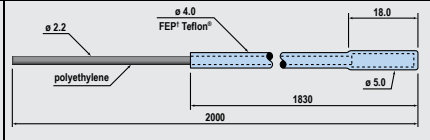
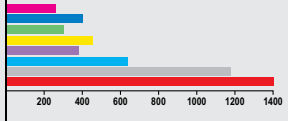
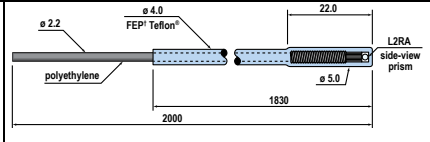
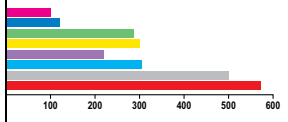
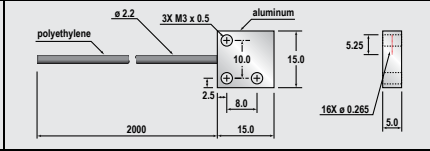
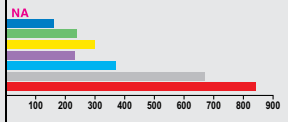
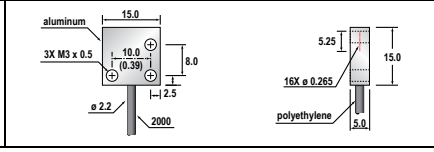
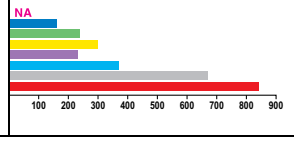
**NA:** WORLD-BEAM QS18 not recommended.

Indicates lens available for model. See page 253 for details.

* Fibers can be free cut using fiber cutter (see page 255).






| Model Number | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|
| Opposed / DURA-BEND™ | PIFM46UHF |  | 1.0 | 1 | • Smooth ferrule; miniature tip | ✓ |  |
| | PIP46UHF |  | 1.0 | 1 | • Thread; bendable tip | ✓ |  |
| | PIPS46UHF |  | 1.0 | 1 | • Smooth ferrule; non-bendable tip | ✓ |  |
| | PIPSB46UHF |  | 1.0 | 1 | • Smooth ferrule; bendable tip | ✓ |  |
| | PIT26UHF |  | 0.5 | 1 | • Thread | ✓ |  |
| | PIT46UHF |  | 1.0 | 1 | • Thread | ✓ |  |
| Chemical Resistant | PIE46UT |  | 1.0 | 25 | • Fluoropolymer encapsulated; lens | ✓ |  |
| | PIE66UTMNL |  | 1.5 | 38 | • Fluoropolymer encapsulated; lens | ✓ |  |
| | PIES46UT |  | 1.0 | 25 | • Fluoropolymer encapsulated; side-view prism | ✓ |  |
| Area Sensing (Array) | PIR1X166U |  | 16X 0.265 | 25 | • Ultra-compact head; straight exit; 5.25 mm width | ✓ |  |
| | PIRS1X166U |  | 16X 0.265 | 25 | • Ultra-compact head; side exit; 5.25 mm width | ✓ |  |

More on next page

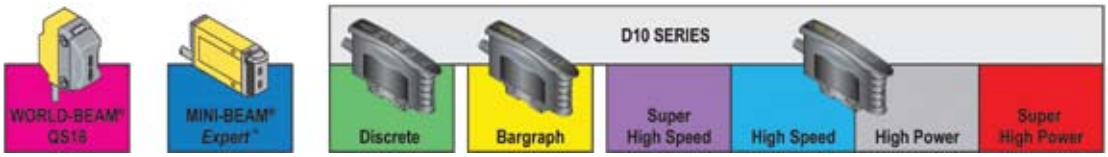


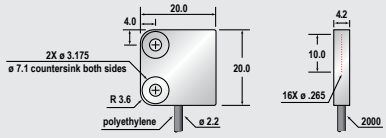
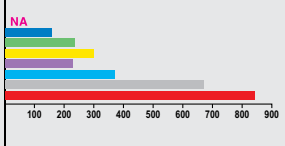
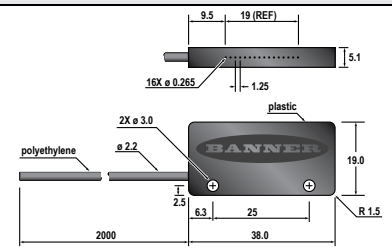
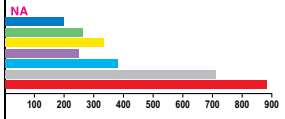
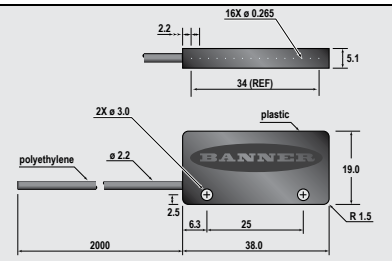
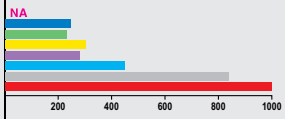
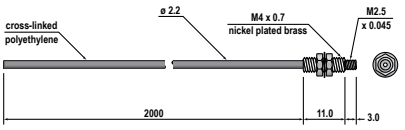
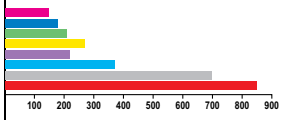
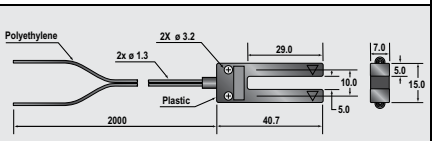
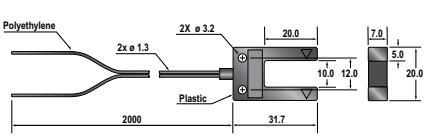
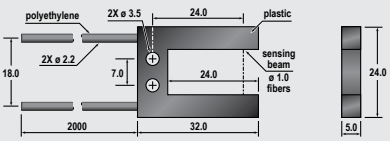
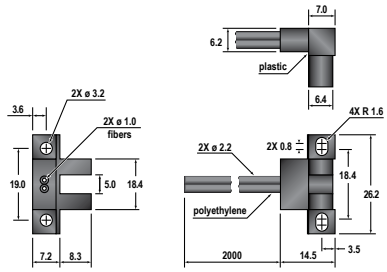
**NA:** WORLD-BEAM QS18 not recommended.

Indicates lens available for model. See page 253 for details.

* Fibers can be free cut using fiber cutter (see page 255).

SENSORS




| Model Number | | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|---|
| Opposed | Area Sensing (Array) | PIRS1X166UM.4 |  | 16X 0.265 | 25 | • Compact head; side exit; 10 mm width | ✓ |  |
| | | PIRS1X166UMPM.75 |  | 16X 0.265 | 25 | • Side exit; 19 mm width | ✓ |  |
| | | PIRS1X166UMPMAL |  | 16X 0.265 | 25 | • Side exit; 34 mm width | ✓ |  |
| | High-Temp | PIT46UHT1 |  | 1.0 | 25 | • Thread; withstands 105° C | ✓ |  |
| | Slot | PDIS16UM5 |  | 0.25 | 10 | Easy mount “fork” head; 5 mm gap | ✓ |  |
| | | PDIS16UM10 |  | 0.25 | 10 | Easy mount “fork” head; 10 mm gap | ✓ |  |
| | | PDIS46UM12 |  | 1.0 | 25 | • Easy mount “fork” head; DURA-BEND fiber | ✓ |  |
| | | PDISM46UM5MA |  | 1.0 | 25 | • 90° angle; compact “fork” head; DURA-BEND fiber | ✓ |  |

More on next page

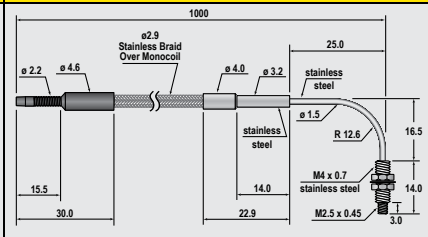
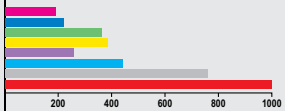
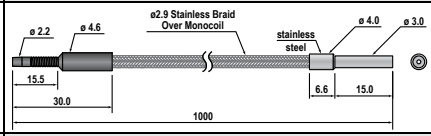
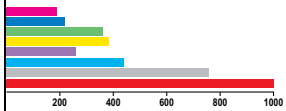
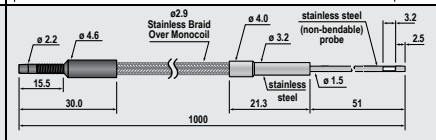
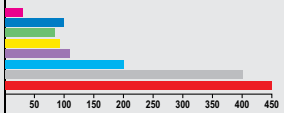
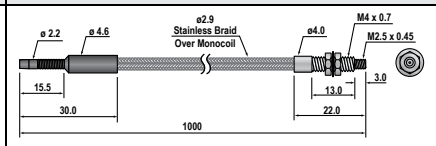
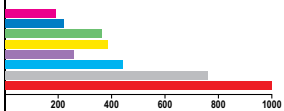
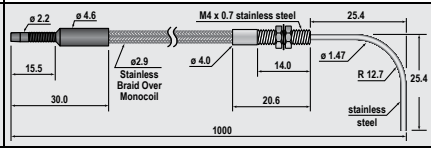
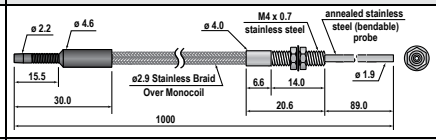
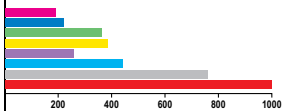
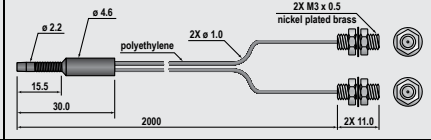
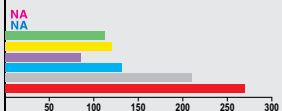
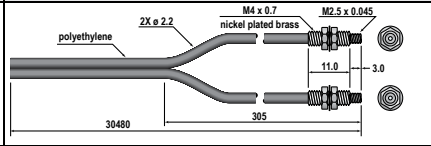
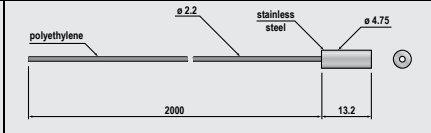
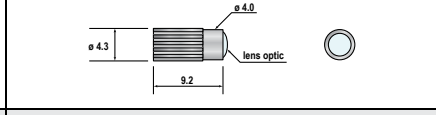
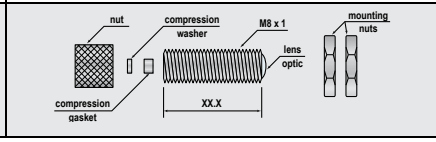
**NA:** WORLD-BEAM QS18 not recommended.

Indicates lens available for model. See page 253 for details.

* Fibers can be free cut using fiber cutter (see page 255).





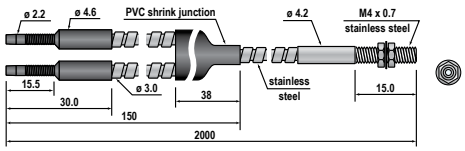
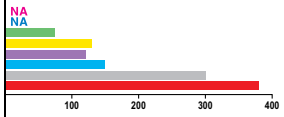
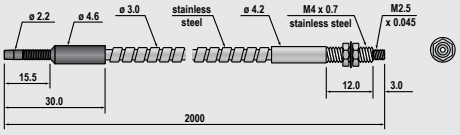
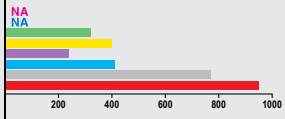

| | Model Number | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|
| Opposed / SteelSkin™ | PIAT43TMB5 |  | 1.0 | 12 | • 90° angle/thread | |  |
| Opposed / SteelSkin™ | PIF43TMB5 |  | 1.0 | 12 | • Smooth ferrule | |  |
| Opposed / SteelSkin™ | PIPS43TMB5 |  | 1.0 | 12 | • Smooth ferrule; non-bendable tip | |  |
| Opposed / SteelSkin™ | PIT43TMB5 |  | 1.0 | 12 | • Thread | |  |
| Opposed / SteelSkin™ | PITA43TMB5 |  | 1.0 | 12 | • Thread/90° angle | |  |
| Opposed / SteelSkin™ | PITP43TMB5 |  | 1.0 | 12 | • Thread; bendable tip | |  |
| Opposed / Dual Individual | PDIT26T5 |  | 0.5 | 12 | • Accomplish 2 inspections using only one sensor | |  |
| Opposed / Dual Individual | PDIT4100U |  | 1.0 | 25 | • 30 m duplex fiber cable | ✓ | Contact factory for sensing range. |
| Opposed / Vacuum | PIF66UM.52M.19D |  | 1.5 | 38 | • For use with VFT-M8MVS (ambient side) See page 261. | ✓ | Contact factory for sensing range. |
| Extended Range Lens | L2 |  | ref. model PIT46U | ref. model PIT46U | • Range-extending lens<br>• M2.5 thread | |  |
| Extended Range Lens | LO8FP |  | ref. model PIL46U | ref. model PIL46U | • Ultra-long range-extending lens; use with raw plastic fiber | |  |

More on next page

**NA:** WORLD-BEAM QS18 not recommended. **NA:** MINI-BEAM *Expert* not recommended. Indicates lens available for model. See page 253 for details.

* Fibers can be free cut using fiber cutter (see page 255).



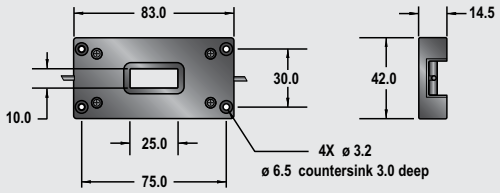
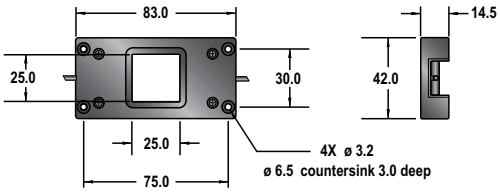
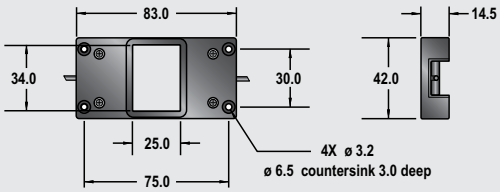

| Model Number | | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Free Cut* | Typical Range (mm) |
|---|---|---|---|---|---|---|---|---|
| Diffuse | High-Temp | BMT16.6S-HT |   | 1.57 | 19 | • High performance glass fiber optics for use with Banner D10 plastic fiber sensors<br>• Miniature thread; end tip withstands 315° C | |   |
| Opposed | High-Temp | IMT.756.6S-HT† |   | 1.27 | 19 | • High performance glass fiber optics for use with Banner D10 plastic fiber sensors<br>• Miniature thread; end tip withstands 315° C | |   |

**NA:** WORLD-BEAM QS18 not recommended. **NA:** MINI-BEAM *Expert* not recommended. Indicates lens available for model. See page 253 for details.

* Fibers can be free cut using fiber cutter (see page 255).

† Fibers are sold separately, must order two fibers to form a pair.

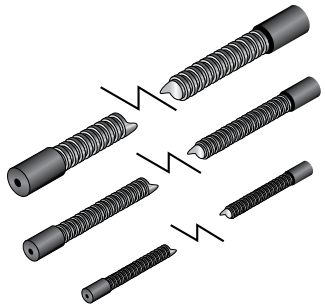
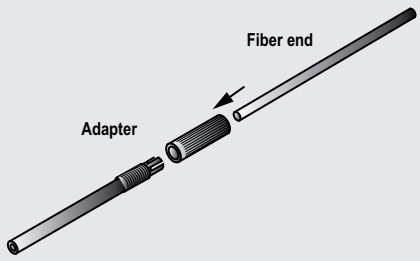
## D10 *Expert*™ Small Object Counter Fiber Optic Arrays

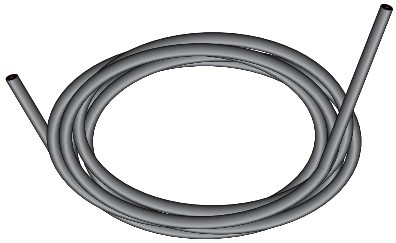
| Model Number* | Fiber Exit | Drawing & Dimensions (mm) | Detection Window | Minimum Object Detection† | Used With |
|---|---|---|---|---|---|
| PFCVA-10X25-S | Side Exit |   | 10 x 25 mm | 1.5 mm | • D10DNCFP...<br>• D10DPCFP... |
| PFCVA-10X25-E | End Exit | | | | |
| PFCVA-25X25-S | Side Exit |   | 25 x 25 mm | 3 mm | |
| PFCVA-25X25-E | End Exit | | | | |
| PFCVA-34X25-S | Side Exit |   | 34 x 25 mm | 4 mm | |
| PFCVA-34X25-E | End Exit | | | | |

* Custom fiber arrays and mounting configurations are possible. Contact factory with your small object counting application.

† With 2% Threshold Offset Percentage

# Fiber Optic Accessories

| Model Number | | Model Specific Features | General Features | Drawings |
|---|---|---|---|---|
| Fiber Cutters | PFK20 | • For use with 0.25 and 0.5 mm diameter cables. | • These kits are used with unterminated plastic fiber cables.<br>• Each kit contains 40 bushings and 10 cutter assemblies (cutters can be purchased separately in packages of 25 - reference model PFC-2-25). |  <br>NOTE: Bushings used with Q45, OMNI-BEAM, ECONO-BEAM, MAXI-BEAM and VALU-BEAM sensors only. |
| | PFK40 | • For use with 1 and 1.5 mm diameter cables. | | |
| Plastic Fiber Field-Installable Sheathing | PFS69S6T | • May be used with bifurcated fiber assemblies having M6 x 0.75 threaded end tips (e.g., PBCT46U, PBP46U, PBT46UHT1 and PBT66U). | • Stainless steel sheathing with stainless steel end fittings (one end internally threaded to capture fiber end tips, other end non-threaded) is used in applications where protection is required for plastic fiber optic cables.<br>• All models listed are 1.8 m in length.<br>• Other lengths are available by contacting Banner Applications Department. |  |
| | PFS53S6T | • May be used with individual or bifurcated fiber assemblies having M4 x 0.7 threaded end tips (e.g., PBCT26U, PBPF26U, PIP46U, PIT46U and PIT66U). | | |
| | PFS44S6T | • May be used with individual fiber assemblies having M3 x 0.5 threaded end tips (e.g., PIP26U, PIT26U and PIT1X46U). | | |
| Plastic Fiber Adapters | UPFA-1-100 | • Use to adapt plastic fiber optic cables with outside jacket diameter of 1.0 mm, such as PIT26U and PBP16U. | • Compression fitting adapters are used with small-diameter unterminated plastic fiber cables.<br>• Use when interfacing small-diameter plastic fibers to D10, D11, D12, QM42, QS18, R55F, FI22 and MINI-BEAM plastic fiber sensor families.<br>• Each kit contains 100 pairs of adapters. One pair will interface either one bifurcated fiber optic cable or a pair of individual cables to a fiber optic amplifier. |  |
| | UPFA-2-100 | • Use to adapt plastic fiber optic cables with outside jacket diameter of 1.25 mm or 1.3 mm, such as PBCT26U and PBF46UM3MJ1.3. | | |

| Model Number | | Core | Length | Type | Drawing |
|---|---|---|---|---|---|
| Unterminated Individual and Bifurcated Plastic Fibers | PIU230U | 0.5 mm | 9 m | Single |  |
| | PIU260U | | 18 m | | |
| | PIU430U | 1.0 mm | 9 m | Single | |
| | PIU460U | | 18 m | | |
| | PIU630U | 1.5 mm | 9 m | Single | |
| | PIU660U | | 18 m | | |
| | PBU430U | 1.0 mm | 9 m | Duplex | |
| | PBU460U | | 18 m | | |

SENSORS

# Glass Fiber Optics

- Solve numerous challenging sensing applications in the most hostile environments, including temperatures up to 480° C, corrosive materials and extreme moisture
- Withstand severe shock and vibration
- Ignore extreme electrical noise
- Constructed of a combination of optical glass fiber, stainless steel, PVC, brass, molded thermoplastics and optical-grade epoxy

## Glass Fiber Optic Model Key

| I | A | T | 2 | 3 | S | X | X |
|---|---|---|---|---|---|---|---|

**ASSEMBLY STYLE designator**

**B** = Bifurcated fiber
**I** = Individual fiber*

**SENSING END TIP STYLE designator**

**A** = 90° Angle
**AM** = Miniature 90° Angle
**AT** = 90° Angle/Thread
**F** = Ferrule
**M** = Miniature Tip
**MP** = Miniature Probe
**MT** = Miniature Thread
**R** = Rectangular Bundle Termination
**T** = Thread
**TA** = Thread/90° Angle
**TETA** = Thread and Extra Tight 90° Angle

**MODIFICATIONS designator**

"MXX" = Sensing end tip modification
"M600" = Sensing end withstands 315° C
"M900" = Sensing end withstands 480° C

**SHEATHING MATERIAL designator**

**S** = Stainless steel flexible conduit
**P** = PVC with galvanized monocoil reinforcing wire

**OVERALL LENGTH designator (in feet)**

**2** = 2 ft. = 610 mm ±38 mm
**3** = 3 ft. = 914 mm ±38 mm

**FIBER BUNDLE DIAMETER designator**

**.44** = 0.7 mm
**.5** = 0.8 mm
**.75** = 1.2 mm
**1** = 1.6 mm
**1.5** = 2.3 mm
**2** = 3.2 mm
**2.5** = 4.0 mm

* Individual glass fibers are packaged separately.

# Glass Fiber Optics Specifications

| | |
|---|---|
| **Construction** | Combination of optical glass fiber, stainless steel or PVC, brass, molded thermoplastics, and optical-grade epoxy. Optical fiber is F2 core, EN1 clad, approx. 50 µm diameter per strand. Flexible steel interlock sheathing is 302 stainless. |
| **Sensing Range** | Refer to the specific fiber optic to be used. |
| **Bend Radius** | Inside bend radius must be 12 mm or greater for PVC covered fiber optic assemblies, and 25 mm or greater for stainless steel armored cable covered fibers. |
| **Length** | Standard length for assemblies is 915 mm; see dimension diagrams.<br>Most models are available from the factory with shorter or longer cable lengths, up to 18 m max. |
| **Length Dimension Tolerance** | **Overall assembly length:** ±12 mm per 300 mm of length<br>**Shrink junction dimensions:** ±12 mm |
| **Implied Dimensional Tolerances** | **All dimensions are in millimeters:** x = ±2.5 mm, x.x = ±0.25 mm and x.xx = ±0.12 mm, unless specified. |
| **Operating Conditions** | Fiber assemblies with stainless-steel (SS) sheathing and metal end tips: -140° to +249° C<br>Fiber assemblies with PVC sheathing and/or plastic end tips: -40° to +105° C<br>Special order assemblies with SS sheathing and metal end tips and model suffix "M600": -140° to +315° C*<br>Special order assemblies with SS sheathing and metal end tips and model suffix "M900": -140° to +480° C*; note dimensional changes from STD models<br><br>* sensing end tip only |



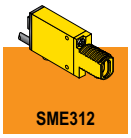
### ⚠ Application Notes and Warnings ⚠

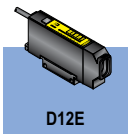
1. The ends of glass fiber optic assemblies are optically ground and polished. Care taken in this manufacturing process accounts for the light coupling efficiency of the fiber optic assembly. As a result, glass fiber assemblies cannot be shortened, spliced or otherwise modified.
2. Use caution when applying fiber optics in hazardous locations. Although fiber optic assemblies are by themselves, intrinsically safe, the sensor and associated electronics must be LOCATED IN A SAFE ENVIRONMENT. Alternatively, fiber optics may be used with sensor model SMI912FQD (page 43). This sensor is approved for use inside hazardous areas when used with an appropriate intrinsic barrier. Also, see NAMUR sensor models Q45AD9F (page 196) and MIAD9F (page 116). Fiber optics do not necessarily provide a hermetic seal between a hazardous environment and the safe environment.
3. In applications where glass fibers to insulate the control from high voltage, specify silicone rubber, Teflon®, or high-density polyethylene sheathing with no reinforcing wire in the cable. It is the responsibility of the user to test each fiber optic assembly for insulation capacity.
4. Do not subject the fibers to sharp bends, pinching, repeated flexing or high levels of radiation.
5. When ordering fiber lengths in excess of 1 m, take into account light signal reduction of 5 percent per 300 mm of additional length.

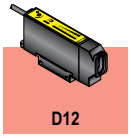
Teflon® is a registered trademark of Dupont™.

SENSORS


R55F


SME312


D12E

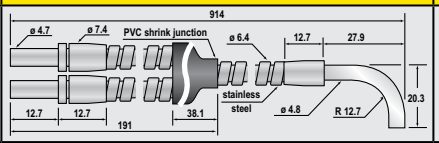
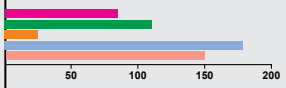
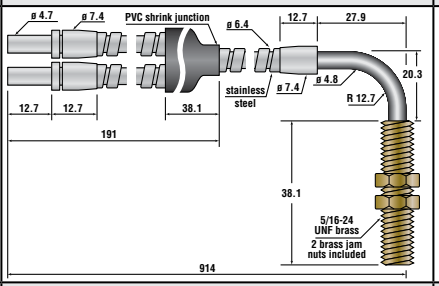
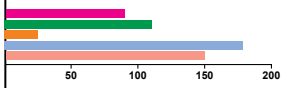
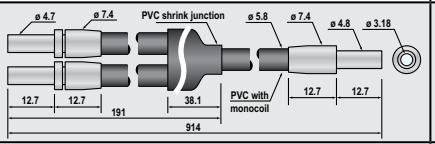
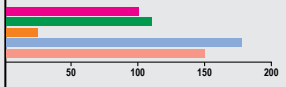
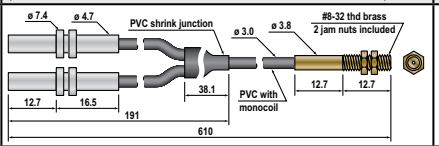
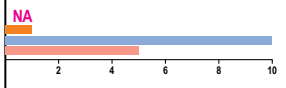
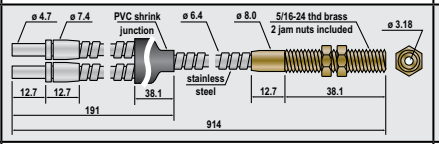
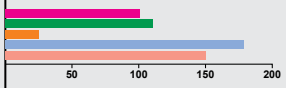
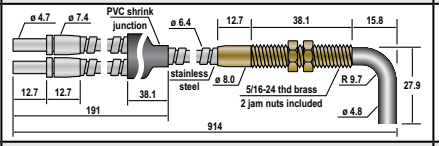
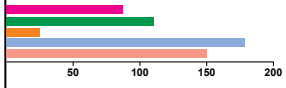
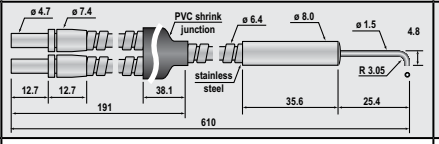
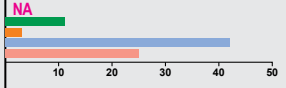
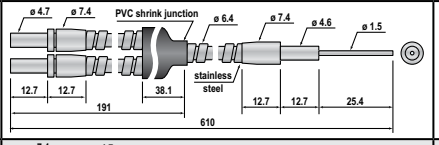
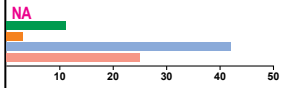
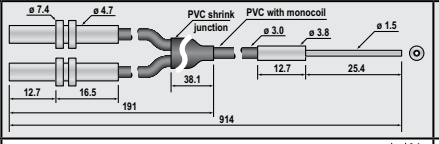
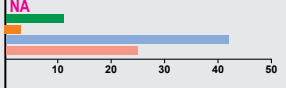
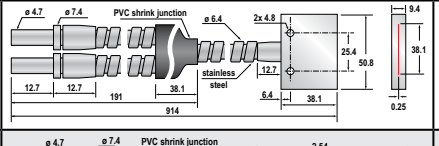
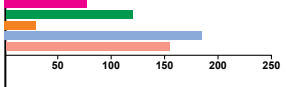
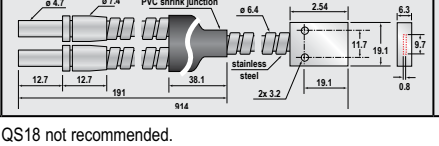
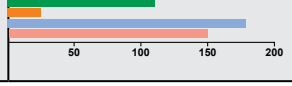

D12


QS18

Indicates lenses available for model. See page 259 for details.

M600 Available 315° C models. Add **M600** to end of model number (example, **BA23SM600**).

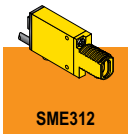
M900 Available 480° C models. Add **M900** to end of model number (example, **BA23SM900**). Dimensions may vary for these models.

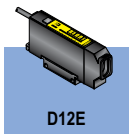
| Model Number | | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Typical Range (mm) |
|---|---|---|---|---|---|---|---|
| Diffuse | Standard | BA23S |  | 3.18 | 19 | • 90° angle<br>M600 M900 |  |
| | | BAT23S |  | 3.18 | 19 | • 90° angle/thread<br>M600 M900 |  |
| | | BF23P |  | 3.18 | 19 | • Smooth ferrule |  |
| | | BMT.442P |  | 0.69 | 9.5 | • Miniature thread |  |
| | | BT23S |  | 3.18 | 19 | • Thread<br>M600 M900 |  |
| | | BTA23S |  | 3.18 | 19 | • Thread/90° angle<br>M600 M900 |  |
| | Miniature Probe | BAM.752S |  | 1.17 | 19 | • ø 1.5 mm non-bendable probe; 90° angle<br>M600 |  |
| | | BM.752S |  | 1.17 | 19 | • ø 1.5 mm non-bendable probe<br>M600 |  |
| | | BMP.753P |  | 1.17 | 9.5 | • ø 1.5 mm non-bendable probe |  |
| | Area Sensing (Array) | BR2.53S |  | 3.96 | 19 | • Straight exit; 38 mm width<br>M600 |  |
| | | BR23S |  | 3.18 | 19 | • Straight exit; 10 mm width<br>M600 |  |

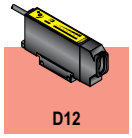
More on next page

NA: WORLD-BEAM QS18 not recommended.


R55F


SME312

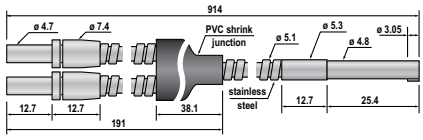
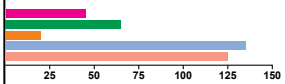
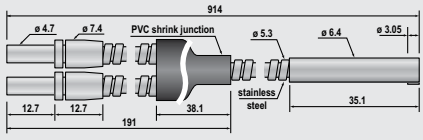
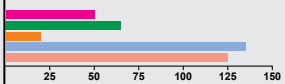
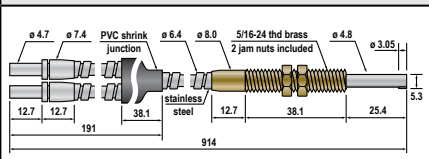
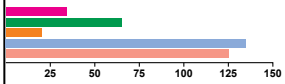
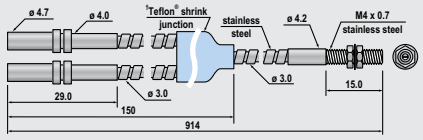
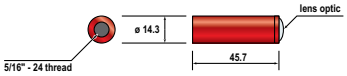

D12E


D12


QS18

M600 Available 315° C models. Add **M600** to end of model number (example, **BA23SM600**).

M900 Available 480° C models. Add **M900** to end of model number (example, **BA23SM900**). Dimensions may vary for these models.

| Model Number | | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Typical Range (mm) |
|---|---|---|---|---|---|---|---|
| Diffuse | Side-View | BA1.53SMETA |  | 2.29 | 19 | • Ultra-compact head<br>M600 |  |
| | | BA1.53SMTA |  | 2.29 | 19 | • Compact head<br>M600 |  |
| | | BTETA1.53S |  | 2.29 | 19 | • Ultra-compact head; thread<br>M600 |  |
| | Vacuum | BMT13SMVF |  | 1.57 | 19 | • Miniature thread; entire cable withstands 480° C | Contact factory for sensing range. |
| | Convergent Beam Spot | L10 |  | ref. glass fiber key or call factory | ref. glass fiber key or call factory | • Glass lens; withstands 315° C<br>• Focuses light to .80 mm with ø 1.6 mm fiber |  |

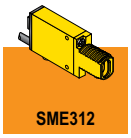


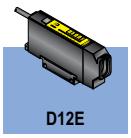

## Glass Fiber Optics—Additional Models Available

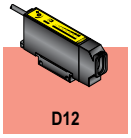
**In addition to the configurations shown, Banner offers thousands of readily available alternative fiber models:**

- Substitute PVC over monocoil sheathing for stainless steel.
- Reduce or increase glass fiber optic bundle diameters.
  Example: Change ø 3.18 mm bundle to ø 1.57 mm.
- Substitute a rectangular-shaped fiber bundle (0.5 x 2.5 mm) for a circular bundle.
- Change endtip material from brass to stainless steel.
- Modify straight or angled probe tip dimensions.
- Modify overall fiber length in intervals of 305 mm (standard lengths are 914 and 610 mm).


R55F


SME312


D12E

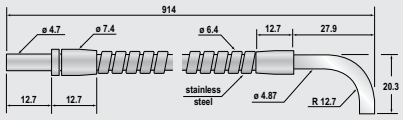
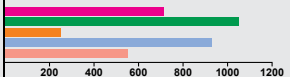
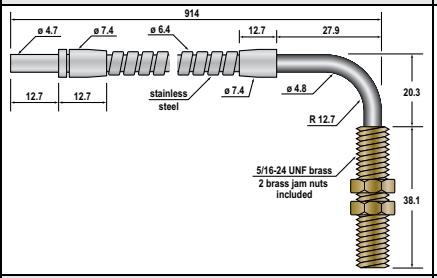
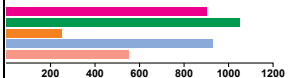
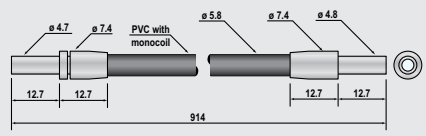
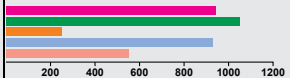
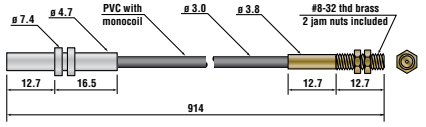
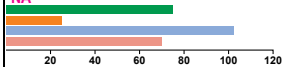
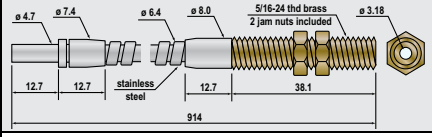
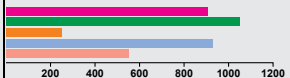
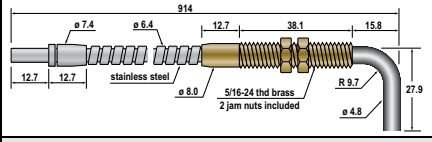
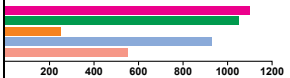
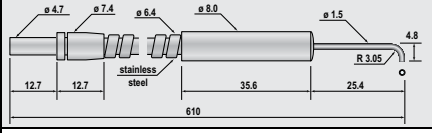
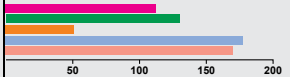
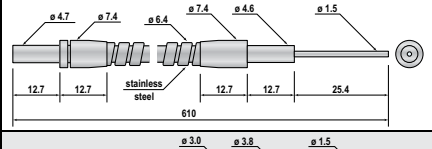
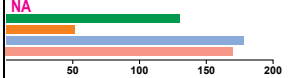
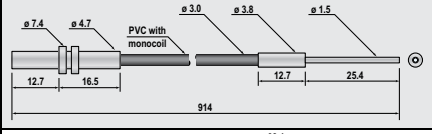
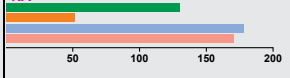
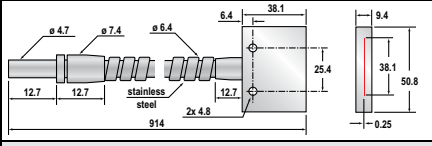
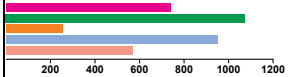
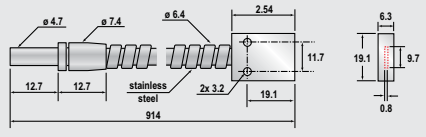
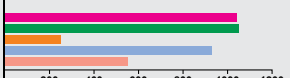

D12


QS18

Indicates lenses available for model. See page 261 for details.

M600 Available 315° C models. Add **M600** to end of model number (example, **BA23SM600**).

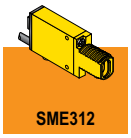
M900 Available 480° C models. Add **M900** to end of model number (example, **BA23SM900**). Dimensions may vary for these models.

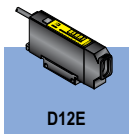
| Model Number | | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Typical Range (mm) |
|---|---|---|---|---|---|---|---|
| Opposed | Standard | IA23S |  | 3.18 | 19 | • 90° angle<br>M600 M900 |  |
| | | IAT23S |  | 3.18 | 19 | • 90° angle/thread<br>M600 M900 |  |
| | | IF23P |  | 3.18 | 19 | • Smooth ferrule<br>M600 M900 |  |
| | | IMT.442P |  | 0.69 | 9.5 | • Miniature thread | NA<br>  |
| | | IT23S |  | 3.18 | 19 | • Thread<br>M600 M900 |  |
| | | ITA23S |  | 3.18 | 19 | • Thread/90° angle<br>M600 M900 |  |
| | Miniature Probe | IAM.752S |  | 1.17 | 19 | • ø 1.5 mm non-bendable probe; 90° angle<br>M600 |  |
| | | IM.752S |  | 1.17 | 19 | • ø 1.5 mm non-bendable probe<br>M600 | NA<br>  |
| | | IMP.753P |  | 1.17 | 9.5 | • ø 1.5 mm non-bendable probe | NA<br>  |
| | Area Sensing (Array) | IR2.53S |  | 3.69 | 19 | • Straight exit; 38 mm width<br>M600 |  |
| | | IR23S |  | 3.18 | 19 | • Straight exit; 10 mm width<br>M600 |  |

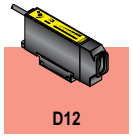
More on next page

NA: WORLD-BEAM QS18 not recommended.


R55F

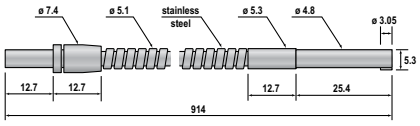
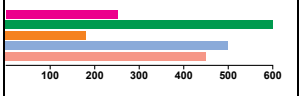
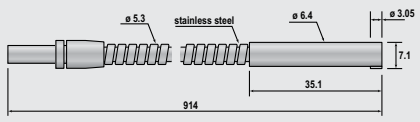
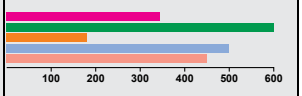
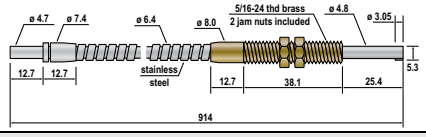
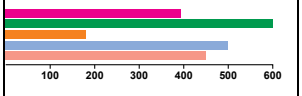
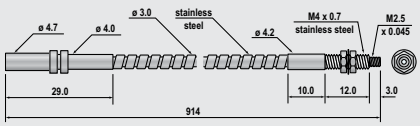
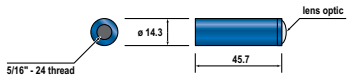
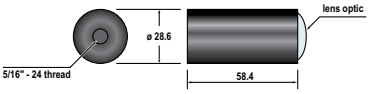
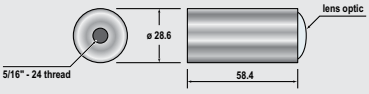
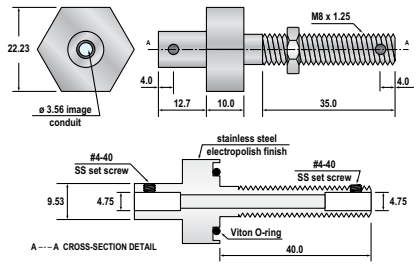
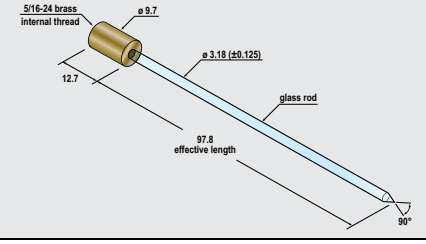

SME312


D12E


D12


QS18

M600 Available 315° C models. Add **M600** to end of model number (example, **BA23SM600**).

| Model Number | | Drawing & Dimensions (mm) | Core Dia. (mm) | Min. Bend Radius (mm) | Features | Typical Range (mm) |
|---|---|---|---|---|---|---|
| Opposed — Side-View | IA1.53SMETA |  | 2.29 | 19 | • Ultra-compact head<br>M600 |  |
| Opposed — Side-View | IA1.53SMTA |  | 2.29 | 19 | • Compact head<br>M600 |  |
| Opposed — Side-View | ITETA1.53S |  | 2.29 | 19 | • Ultra-compact head; thread<br>M600 |  |
| Opposed — Vacuum | IMT.753SMVF |  | 1.27 | 19 | • Miniature thread; entire cable withstands 480° C | Contact factory for sensing range. |
| Opposed — Extended Range Lens | L9 |  | ref. model IT23S | ref. model IT23S | • Glass lens; withstands 315° C |  |
| Opposed — Extended Range Lens | L16F |  | ref. model IT23S | ref. model IT23S | • Plastic housing; withstands 105° C |  |
| Opposed — Extended Range Lens | L16FAL |  | ref. model IT23S | ref. model IT23S | • Aluminum housing; withstands 315° C |  |
| Opposed — Extended Range Lens | L16FSS |  | ref. model IT23S | 19 | • Stainless steel housing withstands 480° C |  |
| Opposed — Vacuum Feed Through | VFT-M8MVS |  | 3.56 | — | • Seals to 1 x $10^{-9}$ torr; withstands 120° C |  |
| Opposed — Liquid Level | TGR |  | 3.18 | — | • Use with BT23S<br>• Sensor switches when tip of glass rod is immersed in liquid |  |